MEDICINAL PLANT REMEDY KNOWLEDGE AND SOCIAL NETWORKS IN TABI,
YUCATAN, MEXICO

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2009

1
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To my family, in the broadest sense of the word
ACKNOWLEDGMENTS

A number of people contributed to the making of this dissertation. My chair, Dr. John Richard Stepp, and co-chair, Dr. Christopher McCarty, provided me with exceptional scholarly guidance and encouragement over the course of my graduate training. My committee members, Drs. Juan Jimenez-Osornio, Walter Judd, Francis “Jack” Putz, and Marianne Schmink, each contributed their unique talents to my intellectual development and the formation and completion of this research. Dr. H. Russell Bernard made important contributions to my research design and methodology. Communication with Drs. Eugene Anderson and Betty Faust helped broaden my understanding of medicinal plant use within the context of the Yucatan Peninsula. My friends and fellow members of our dissertation support group, Hilary Zarin and Suzanne Grieb, provided me with essential moral support, editorial help, and guidance through the seemingly never-ending process of acquiring a PhD. Kristal Arnold, a free lance editor and friend, greatly improved the dissertation by line editing the document. Jack Putz also provided me with extensive editorial help, for which I am very grateful. Cerian Gibbes marked the location of Tabi on a map of the Yucatan for me.

I am thankful for the love and emotional support my family and friends have provided me over the course of these five years. I will be ever indebted to my mother and step-father, Susan and Donald Reifert, for opening their home and their hearts to me during a time of particular strain for me. Merlin Hopkins, my father, always encouraged my intellectual pursuits and contributed to the development of my research through many casual conversations. My step-mother, Sandy Hopkins; my brother and sister-in-law, Eric and Sarah Hopkins; my grandmother, Ann Howard; and my extended family and friends in Michigan were always extremely supportive even though they were not always sure exactly what I do. My grandmother is particularly happy that I am graduating because now I “can get a real job.” Andrea and Patrick
Gaughan, Cerian Gibbes, and Phillip Morris are fantastic friends on whom I could always rely for a place to stay in Gainesville when I came back for visits from the field.

In the Yucatan, I am blessed with two “families,” the Inurreta Diaz in Merida and the Cetz Canche in Tabi. Linda Diaz de Inurreta is a great caretaker and kindred spirit. Armando Inurreta Diaz helped me in countless ways, including exploring out-of-the-way villages in the Yucatan, patiently explaining concepts that are not easily translated from Spanish to English, and providing me with constant moral and emotional support. I am eternally grateful to him. The Cetz Canche—Maximiliano, Eloisa, Victoria, Francisco, Maria Victoria, Amira, Rosy, Eliza, Pedro, Melody, Faustina, Sofi, Eliazar, Leticia, Alejandro, Marta, Jose Angel, Gustavo, Beatriz, and Sandy—changed my life by reminding me of the importance of love and laughter. I am so grateful to them for all their guidance. I am thankful for the generosity expressed to me by the people of Tabi. Thanks to Guadalupe Chan Poot and Layda Chan Ku, my research assistants, for their help in executing this project. The plant identification portion of this project was made possible largely because of the help of Dr. Germán Carnevali Fernández-Concha, José Luis Tapia Muñoz, and Silvia Hernández Aguilar from the herbarium at the Centro de Investigación Científica de Yucatán and Dr. Walter Judd and Kent Perkins from the herbarium at the University of Florida.

I am grateful to the National Science Foundation and the executive committee of the Working Forests in the Tropics IGERT program for funding my studies and providing me with excellent interdisciplinary training. I am appreciative of the United States Department of Education for providing me with funds to pursue language training in Yucatec Maya and the National Science Foundation for funding this research. Lastly, I am thankful the department of
anthropology awarded me the John M. Goggin Memorial Scholarship to help defray the costs of the preparation of this dissertation.
# TABLE OF CONTENTS

ACKNOWLEDGMENTS.................................................................................................................... 4

LIST OF TABLES.............................................................................................................................. 10

LIST OF FIGURES............................................................................................................................ 12

LIST OF ABBREVIATIONS............................................................................................................ 14

ABSTRACT ........................................................................................................................................ 15

CHAPTER

1  INTRODUCTION....................................................................................................................... 17

Theoretical Models of Cultural Knowledge and Structure for Knowledge Sharing ............... 22

   Cognitive Theory of Culture Defines Knowledge as Agreement............................................. 23

   Representation of Knowledge-Sharing Relationships Using Social Network Analysis ................................................................................................................................. 28

   Hypotheses on Herbal Remedy Variation, Attribute, and Relational Variables .................. 32

Conclusion ................................................................................................................................... 33

2  YUCATAN.................................................................................................................................. 37

   Geographical Location of Study and Global Integration .......................................................... 38

   Biophysical Constraints on and Human Modification of Plant Resources ............................. 41

   Sociocultural Factors and Herbal Knowledge ........................................................................... 47

      History of Natural Resource Use ........................................................................................ 48

      Social Organization, Division of Labor, and Economics ...................................................... 52

      The Relationship Among Diet, Illness, and Treatment Choice ........................................ 58

      Language and Education and Herbal Knowledge Transmission ....................................... 63

      Religion and Politics: Barriers to the Flow of Herbal Knowledge .................................... 65

Conclusion ................................................................................................................................... 68

3  METHODS .................................................................................................................................. 78

   Site Selection ............................................................................................................................... 78

   Community Support .................................................................................................................... 81

   The Research Team ..................................................................................................................... 81

   Sampling Frame .......................................................................................................................... 83

   Informed Consent and Compensation ........................................................................................ 84

   Defining the Domain ................................................................................................................... 85

   Unstructured Data Collection to Inform Structured Surveys ................................................... 86

      Participant Observation of Life in Tabi .............................................................................. 87

      Free-listing of Medicinal Plant Remedies .......................................................................... 88
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1</td>
<td>Accession numbers, family, scientific name, collection date, and collectors’ initials for the plant species from common remedies collected and deposited in herbaria</td>
<td>105</td>
</tr>
<tr>
<td>3-2</td>
<td>The illnesses and corresponding scientific names constitute the remedies used in the medicinal plant exam</td>
<td>108</td>
</tr>
<tr>
<td>3-3</td>
<td>The illness names listed in Maya are the illnesses treated by herbal remedies that were included in the medicinal plant exam</td>
<td>110</td>
</tr>
<tr>
<td>3-4</td>
<td>Items used to develop a relative economic prosperity Guttman scale</td>
<td>111</td>
</tr>
<tr>
<td>3-5</td>
<td>Items used to develop a traditional lifestyle Guttman scale</td>
<td>112</td>
</tr>
<tr>
<td>4-1</td>
<td>The illnesses free-listed were classified into general illness categories</td>
<td>151</td>
</tr>
<tr>
<td>4-2</td>
<td>The family, scientific, and local Yucatec Maya and/or Spanish names of the plant species of common remedies focused on in this study</td>
<td>152</td>
</tr>
<tr>
<td>4-3</td>
<td>Information on the utilization of the plant species in other areas of the Yucatan Peninsula and the wild distribution of the plant species including the sources of the information</td>
<td>154</td>
</tr>
<tr>
<td>4-4</td>
<td>Information about the plant species including its life form, where it was collected, its perceived abundance by community members, and other uses for it in Tabi</td>
<td>158</td>
</tr>
<tr>
<td>4-5</td>
<td>The common remedies from the free-list including the species in the remedy and the illness(es) it is used to treat</td>
<td>161</td>
</tr>
<tr>
<td>5-1</td>
<td>Relationships between mean herbal remedy competence scores and categorical attribute variables are tested</td>
<td>211</td>
</tr>
<tr>
<td>5-2</td>
<td>Correlations between continuous attribute variables and medicinal plant remedy competence scores</td>
<td>211</td>
</tr>
<tr>
<td>5-3</td>
<td>Descriptive statistics for the experiences study participants from Tabi had traveling and living in other places</td>
<td>212</td>
</tr>
<tr>
<td>5-4</td>
<td>The relationship between mean herbal remedy competence scores and categorical relational variables</td>
<td>215</td>
</tr>
<tr>
<td>5-5</td>
<td>Correlation between continuous relational variables and medicinal plant remedy competence scores</td>
<td>215</td>
</tr>
<tr>
<td>5-6</td>
<td>Descriptive statistics for whole-network measures</td>
<td>215</td>
</tr>
</tbody>
</table>
5-7  Descriptive statistics for individual positional relational variables including mean, standard deviation, and range .................................................................................................................. 216

A-l  Timeline the research for this study was performed ................................................................................................................................. 237
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1</td>
<td>Map of Tabi’s location in the Yucatan Peninsula of Mexico</td>
<td>70</td>
</tr>
<tr>
<td>2-2</td>
<td>The Catholic church, located in the center of Tabi, was built in 1700</td>
<td>71</td>
</tr>
<tr>
<td>2-3</td>
<td>The health care clinic in Tabi was established in the 1980s and is run by the Servicios de Salud de Yucatán</td>
<td>71</td>
</tr>
<tr>
<td>2-4</td>
<td>All plants in this region including cultivated plants, like the squash growing in this farm field, and medicinal plants grow in thin and rocky soils</td>
<td>72</td>
</tr>
<tr>
<td>2-5</td>
<td>The sinkhole is an important landmark in the center of Tabi and was a source for water before running water was installed in the 1980s</td>
<td>72</td>
</tr>
<tr>
<td>2-6</td>
<td>Leaves and ephemeral herbs, important ingredients for herbal remedies, return to the landscape during the early wet season</td>
<td>73</td>
</tr>
<tr>
<td>2-7</td>
<td>During the dry season it is difficult to find some medicinal plants because the leaves fall off trees and many of the herbs disappear</td>
<td>73</td>
</tr>
<tr>
<td>2-8</td>
<td>Yards and home gardens are the most common place to gather the ingredients for common herbal remedies in Tabi</td>
<td>74</td>
</tr>
<tr>
<td>2-9</td>
<td>Medicinal plants that are not available in yards and home gardens are often found along trails to farm fields</td>
<td>74</td>
</tr>
<tr>
<td>2-10</td>
<td>Traditional housing compounds are the location of many herbal remedy learning opportunities</td>
<td>75</td>
</tr>
<tr>
<td>2-11</td>
<td>Most housing compounds now include a block house constructed with the materials from FONDEN</td>
<td>75</td>
</tr>
<tr>
<td>2-12</td>
<td>The women’s domain in Tabi is the home and the yard</td>
<td>76</td>
</tr>
<tr>
<td>2-13</td>
<td>The domain of men in Tabi is the farm field and the forest</td>
<td>76</td>
</tr>
<tr>
<td>2-14</td>
<td>Mexican hairless pigs are the favorite animal to consume in Tabi because of their high fat content and rich flavor</td>
<td>77</td>
</tr>
<tr>
<td>4-1</td>
<td>Herbal remedy knowledge varies among residents of Tabi based on the data free-listing exercise</td>
<td>160</td>
</tr>
<tr>
<td>4-2</td>
<td>Knowledge about plant names that are used in common remedies varies among residents of Tabi based on the data free-listing exercise</td>
<td>162</td>
</tr>
</tbody>
</table>
4-3 The competence scores show that the agreement in common herbal remedies varies considerably from 0.95 to 0.10 .......................................................................................................................... 163

5-1 The percentage of people who had completed each grade in school ........................................... 211

5-2 The percentage of people in each religion in Tabi ...................................................................... 212

5-3 The percentage of people in Tabi in different levels of relative economic prosperity using a scale developed locally ........................................................................................................ 213

5-4 The percentage of people in Tabi with different types of lifestyles using a scale developed locally ........................................................................................................................................... 213

5-5 The figure represents the medicinal plant inquiry social network in Tabi ................................... 214

5-6 The bars represent the mean competence scores of individuals located in isolate (N=18), bicomponent (N=84), and cut-point (N=14) positions within the medicinal plant social network ........................................................................................................................................ 216

5-7 There is a positive association between competence score (agreement about medicinal plant remedies) and age (r=0.46, p<0.01, N=59) for individuals from 16 through 45 years of age ................................................................................................................................. 217

5-8 There is no association between competence score (agreement about medicinal plant remedies) and age (r=0.13, p=0.32, N=57) for individuals from 45 through 87 years of age ........................................................................................................................................ 217

5-9 There is no association between in-degree and age for individuals from 15 through 50 years of age (r=0.19, p=0.10, N=72) ........................................................................................................................................... 218

5-10 There is a positive association between in-degree and age for individuals from 51 through 87 years of age (r=0.42, p<0.01, N=44) .................................................................................................................. 218
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Celsius</td>
</tr>
<tr>
<td>CCA</td>
<td>Cultural consensus analysis</td>
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<tr>
<td>CCM</td>
<td>Cultural consensus model</td>
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<tr>
<td>cf</td>
<td>Consult</td>
</tr>
<tr>
<td>CICY</td>
<td>Centro de Investigación Científica de Yucatán</td>
</tr>
<tr>
<td>CINVESTAV</td>
<td>Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeters</td>
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<tr>
<td>F</td>
<td>Fahrenheit</td>
</tr>
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<td>ha</td>
<td>Hectares</td>
</tr>
<tr>
<td>IAR</td>
<td>Informant agreement ratio</td>
</tr>
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<td>in</td>
<td>Inches</td>
</tr>
<tr>
<td>INEGI</td>
<td>Instituto Nacional de Estadística y Geografía</td>
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<tr>
<td>LEK</td>
<td>Local ecological knowledge</td>
</tr>
<tr>
<td>m</td>
<td>Meters</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeters</td>
</tr>
<tr>
<td>PAN</td>
<td>National Action Party</td>
</tr>
<tr>
<td>PRD</td>
<td>Party of the Democratic Revolution</td>
</tr>
<tr>
<td>PRI</td>
<td>Institutionalized Revolutionary Party</td>
</tr>
<tr>
<td>SEMARNAT</td>
<td>Secretaría de Medio Ambiente y Recursos Naturales</td>
</tr>
<tr>
<td>SNA</td>
<td>Social network analysis</td>
</tr>
<tr>
<td>SSY</td>
<td>Servicios de Salud de Yucatán</td>
</tr>
<tr>
<td>TEK</td>
<td>Traditional ecological knowledge</td>
</tr>
<tr>
<td>UADY</td>
<td>Universidad Autónoma de Yucatán</td>
</tr>
</tbody>
</table>
Common medicinal plant remedy knowledge is transmitted between individuals who are connected through a social network. Although, overall network structure and individuals’ positions within a network influence the flow of information and individual access and control over its distribution, very few studies have attempted to describe patterns in individual herbal knowledge using relational variables. This study addressed that issue by focusing on the question: to what extent does individual network position explain variation in herbal knowledge across households in a Yucatec Maya community in Mexico, independent of attribute characteristics of the individual?

A medicinal plant remedy knowledge test was used to calculate individual competence scores using cultural consensus analysis in Tabi, Yucatan Mexico. Whole network data were gathered by asking the participants to identify whom they have asked about medicinal plants from a roster of names of all the participants in the study. Various measures of social position were performed on these data using social network analysis. In addition, to capture information on relevant attribute variables, structured interviews were carried out with all participants.
Individual medicinal plant competence scores were positively correlated with age, number of years living in Tabi, and two positional network variables (in-degree and in-closeness) and negatively correlated with number of years completed in school and scores that indicated a relatively modern lifestyle. In addition, nonliterate individuals had higher competence scores than literate individuals. A multiple regression analysis revealed that only age was correlated with individual competence scores after controlling for all other variables. The sample was then divided into two age cohorts and the relationship between age, in-degree, and competence scores was tested within the two age groups. There was a positive correlation between age and competence score for individuals 45 and under and no relationship for individuals 46 and older. There was no relationship between in-degree and competence scores for individuals 50 and under and a positive correlation between those 51 and older. These findings and ethnographic data suggest that individuals tend to accumulate medicinal plant knowledge while they are rearing their children and after their children are grown they become disseminators of the knowledge.
CHAPTER 1
INTRODUCTION

Cultural knowledge, including medicinal plant remedy knowledge, varies not only between social groups but also within groups (Reyes-Garcia et al. 2007, Sapir 1938, Wallace 1961). Since the 1970s researchers have been exploring what factors explain differences in ecological knowledge within a group (Boster 1986, Ellen 1979). Variation in individual knowledge has been attributed to many personal characteristics, such as gender (Browner 1991, Camou-Guerrero et al. 2008, Voeks 2007), age (Begossi 2002, Phillips and Gentry 1993a), livelihood strategies (Pilgrim, Smith, and Pretty 2007, Quinlan and Quinlan 2007), formal education (Ohmagari and Berkes 1997, Zarger 2002b), range and migration (Casagrande 2002, Voeks and Leony 2004), religion (Caniago and Siebert 1998, Voeks and Leony 2004), relative economic prosperity (Benz et al. 2000, Pilgrim et al. 2008), acculturation (Trotter and Logan 1986, Zent 2001), and individual talents and motivations (Krupnik and Vakhtin 1997, Quinlan and Quinlan 2007).

Traditional ecological knowledge (TEK) and associated skills tend to be acquired through participation in daily life (Gaskins 1999, Hunn 2002a, Zarger 2002b). Medicinal plant remedy knowledge is no exception; it is acquired by non-specialists through observation, participation in illness events, and discussions of potential treatments for illnesses (Casagrande 2002). Thus most people learn about medicinal plants from others. Experimentation and innovation of medicinal plant remedies is generally left to specialists, such as herbalists or curers (Casagrande 2005). Since medicinal plant remedy knowledge tends to be socially acquired among non-specialists, social networks are the structure through which some knowledge is transmitted. Social network research has shown that an individual’s position within a network can affect their access to knowledge and resources flowing through the network (Burt 1992, Granovetter 1973). A handful
of studies have applied that concept to ecological knowledge by testing the relationship between distribution of ecological knowledge and relational variables (Atran et al. 2002, Bodin, Crona, and Ernstson 2006, Crona and Bodin 2006, Isaac et al. 2007, Newman and Dale 2005, Ross 2002, Tompkins and Adger 2004). A few researchers have alluded to the potential for social structures to influence the distribution of herbal knowledge by providing opportunities, as well as constraints, on the sharing of knowledge (Casagrande 2002, Vandebroek et al. 2004), although only one study empirically tested the relationship between medicinal plant remedy knowledge and social network variables (Reyes-Garcia et al. 2008b).

The main research question and the hypotheses in this study empirically tested the relationship between an individual’s position within a medicinal plant remedy knowledge inquiry network and the amount of herbal remedy knowledge they possess relative to the rest of the individuals in the network. The main research question was: to what extent does individual network position explain variation in herbal knowledge across households in a Yucatec Maya community in Mexico, independent of attribute characteristics of the individual? This question was addressed by focusing on the following objectives:

- Determine the common medicinal plant remedies known
- Describe the distribution of individual herbal knowledge
- Ascertain the relationship between attribute and relational variables and herbal knowledge

Medical ethnobotanical knowledge systems are constantly changing, as are other socially acquired knowledge systems. Carley (1986) developed a theory of social knowledge acquisition called constructualism that describes the process of evolving knowledge systems. She described it as follows:
Constructuralism is the theory that the social world and personal cognitive world of the individual continuously evolve in a reflexive fashion. The individual’s cognitive structure (his knowledge base), his propensity to interact with other individuals, social structure, social meaning, social knowledge, and consensus are all being continuously constructed in a reflexive, recursive fashion as the individuals in society interact in the process of moving through a series of tasks that constitute daily life, they interact and, in doing so, they acquire knowledge. What knowledge they acquire and whom they interact with are factors which are intimately related. Central to the constructualist theory are the assumptions that individuals process and communicate information during interactions, and the accrual of new information produces cognitive development, changes in the individuals’ cognitive structure. (Carley 1986:386)

This dynamic process of knowledge acquisition explains the subtle changes that occur in shared knowledge systems over time. This sort of variation is considered normal and is characteristic of an intact ethnobotanical system. However, there are processes, such as globalization, modernization, migration, and acculturation, that frequently lead to changes in the timing of knowledge acquisition and an overall reduction in knowledge obtained by individuals within a group (Benz et al. 2000, Cox 2000, Heckler 2002, Krupnik and Vakhtin 1997, Ohmagari and Berkes 1997, Peroni and Hanazaki 2002, Pilgrim et al. 2008, Quinlan and Quinlan 2007, Reyes-Garcia et al. 2005, Voeks and Leony 2004, Zent 2001, Zent and López-Zent 2004). Over time this leads to a derivation from the maximum potential for knowledge in a given system.

People in Tabi have been subject to processes that frequently affect acquisition and transmission of TEK. There is no baseline of medical ethnobotanical knowledge shared by members of Tabi before they were subjected to these processes. Therefore it is difficult to definitively assess changes in knowledge over time; however, there was ethnographic evidence that young members of the community were not as interested in learning about medicinal plants as their elders. This decline in interest likely led to a change in patterns of knowledge acquisition and an overall decrease in the amount of traditional herbal remedy knowledge being transmitted. More specific evidence of the effects of changes in the community on herbal remedy knowledge
is discussed in the age and lifestyle change sections in Chapter 5. In addition, the impact of lifestyle on knowledge is controlled for in the multiple regression analysis. The patterns in knowledge distribution and the relationship between individual knowledge and personal and relational variables presented should be considered with the understanding that the knowledge system being described is somewhat degraded. The patterns in knowledge distribution reported and the factors and their impact on variation in knowledge are likely different in this system than in a system with more or less derivation from the maximum potential. However, the findings in this study are likely representative of places where medical ethnobotanical knowledge levels and acquisition and transmission are being affected by processes such as globalization, modernization, migration, and acculturation.

In addition to focusing on a knowledge system that is degraded to some extent, this study centered on common knowledge within the domain of herbal remedies. The focus on non-specialist herbal knowledge was deliberate. The treatment of illnesses usually starts at home and only after home remedies are deemed unsuccessful do people seek the advice of a professional, such as a scientific medical doctor or a traditional healer (Anderson 2005b). Thus the pervasiveness of the treatment of illness in the home warrants a need to understand how non-specialists learn about herbal treatments. Berlin and Berlin (1994) noted that many medical ethnobotanical studies focus on knowledge held by local specialists. Many of these studies focus on the ceremonial healing rituals, special prayers, and shamanic divination that are often employed in healing supernatural illnesses, and thus provide few insights into the empirical treatment of sicknesses with herbal medicines. Recently there was an increase in studies focused on remedies known by healers to treat natural illnesses (Johns, Kokwaro, and Kimanani 1990). The processes that non-specialists go through are often unique to healers and merit attention as
well (cf. Caniago and Siebert 1998, Geissler et al. 2002, Ghimire, McKey, and Aumeeruddy-
Thomas 2004, Prince et al. 2001, Sternberg et al. 2001, Vandebroek et al. 2004). In this study
herbal knowledge, pathways for knowledge transmission, and key individuals for knowledge
sharing were identified. This information can be used to increase understanding of acquisition
and treatments used to cure illnesses by non-specialists and in conservation initiatives to foster
herbal knowledge acquisition throughout the community.

A distinction is made in this study between scientific and traditional medicines. Scientific
medicine is a type of medicine where knowledge is advanced through the use of the scientific
method. Scientific medical doctors or physicians are the specialists that use scientific medicine to
heal. Scientific medical doctors believe that all illnesses have an organic cause and eventually
the cause and appropriate cure will be discovered (Worsley 1982). The prescription of
synthetically derived pharmaceuticals and surgery are two common methods of treatment used in
scientific medicine. Over-the-counter pharmaceuticals can be used for treatment of illnesses in
the home. The knowledge that is used in traditional medicine is acquired over time through trial
and error and observation and is typically maintained orally. Traditional healers or curers are the
specialist practitioners of traditional medicine. They believe that most illnesses are caused by
lifestyle. Their treatments focus on returning the individual to a state of equilibrium with society,
the natural world, and the supernatural world. Some of their treatment techniques include
herbology, acupuncture, and massage (Garcia, Sierra, and Balam 1999). Medicinal plants are
common home treatments.

Although a study of intra-cultural knowledge variation and its relationship to relational
variables can be performed in any cultural knowledge domain, I chose to focus on the domain of
medicinal plants for several reasons. The first reason is that knowledge in this domain is crucial
to the well-being of rural people around the world (Farnsworth et al. 1985). In addition, it was suggested that medicinal plant remedy knowledge is more susceptible to loss due to acculturation than other domains of TEK (Phillips and Gentry 1993a). Despite the importance and susceptibility of herbal remedy knowledge, the number of studies carried out on individual knowledge variation and relational variables within this domain is limited (cf. Reyes-Garcia et al. 2008b for a notable exception).

I decided to work with a Yucatec Maya community because of their long history in the Yucatan Peninsula, their extensive pharmacopeia, and their ability to adapt and combine cultural knowledge from other groups into their own knowledge and uses. In addition, I was attracted by the lack of past research on individual herbal knowledge variation in this geographical region. The majority of work in this region on herbal remedies was done by botanists with a focus on specialist knowledge and etic illness categories (cf. Arellano Rodríguez et al. 2003 for compilation of ethnobotanical information on Yucatan). In addition, there were some studies from the region on selection of medicinal plants and pharmacological properties of the plants (Ankli et al. 2002, Ankli, Sticher, and Heinrich 1999a, Ankli, Sticher, and Heinrich 1999b, Ankli 2000) and health care and ethnomedicine (Anderson 2005a, Garcia, Sierra, and Balam 1999). The reason I selected Tabi as the specific location to carry out this project is addressed in Chapter 3.

**Theoretical Models of Cultural Knowledge and Structure for Knowledge Sharing**

Two major theoretical perspectives were used in this research: cognitive anthropology and social network analysis (SNA). The following subsections consider each of these theoretical perspectives in depth.
Cognitive Theory of Culture Defines Knowledge as Agreement

Cognitive anthropology is particularly well suited for studies of intra-cultural knowledge variation because of its focus on the portion of culture that resides in the mind and its conception of culture as discrete units and socially distributed. Thus theoretical perspectives from cognitive anthropology were used in this study to define the variation in knowledge about herbal remedies.

Cognitive anthropology, a field focused on how culture relates to cognitive processes, began as a self-aware discipline around the same time as the acceptance of the existence of intra-cultural variation became widespread in anthropology. McQuown (1982) contributed to its inception in the 1950s by applying the procedure used to study variation in language by linguistic anthropologists to the study of cultural variation. For the first time, cultural anthropologists had a method with which they could explain variation in cultural knowledge among individuals within a group. Since its inception, cognitive anthropology developed into four phases. In the first phase, which took place during the 1960s, the guiding theoretical model was the definition of culture as knowledge and the main research goals were to identify the content and organization of such knowledge (D’Andrade 1995). The theoretical model guiding the second phase was the organization of cultural categories discovered through the analyses of words. There was a strong debate during this phase regarding the locus of culture. Many anthropologists were convinced culture was not just located in the mind but also in physical representations (Geertz 1973). Cognitive anthropologists accepted this; although, they chose to emphasize the part of culture located in the mind\(^1\) (D’Andrade 1995). This phase was most heavily developed from the 1950s to 1970s. During the third phase, beginning in the mid-1970s,

\(^1\) The focus of cognitive anthropologists is on the mind, which includes mental processes such as feeling, perceiving, thinking, willing, and reasoning. They do not focus on the brain, which is the portion of the central nervous system located in the skull.
investigators used psychological theories to guide research with the goal of understanding mental processes such as reasoning, metaphor, and memory. In the 1990s the fourth phase began developing. In this phase the definition of culture was modified based on information from research developed in the first three phases. The following research trends developed during this phase: 1) understanding how emotion, motivation, and socialization help form cultural schema and then influence action, 2) studying the relationship between cognitive structure, physical structure of artifacts, and behavioral structure of groups, and 3) modeling cultural consensus and distributed cognition. Research is still being done in each of these phases concurrently.

Cognitive anthropology developed during a time when the dominant theoretical positions in anthropology were structuralism and symbolic anthropology (D'Andrade 1995). These theoretical perspectives assumed that culture was one structure of meaning and symbols that was expressed in cultural materials and behaviors. Thus the theories developed using these perspectives were based on an idea that culture was common, shared, and homogenous (Pelto and Pelto 1975). Increasingly, however, cognitive anthropologists found evidence that intra-cultural variation did exist and they began challenging assumptions of cognitive homogeneity and behavioral sharing (Roberts 1964, Wallace 1961). Even though the dominant theoretical perspectives at the time ignored variation within cultural groups, there were antecedents in anthropology that helped in the development of the cognitive anthropological perspective. For example, in the late 1800s Boas and Tylor observed that distinctions in individuals were related to systematic patterns in behaviors and thoughts (Handwerker 2002). Kroeber (1948) and White (1949) further developed this idea by defining the patterns as superorganic wholes. Sapir (1949) added to the foundation of cognitive anthropology by showing that the base of the superorganic whole is in the mind of individuals and is expressed through situation-specific interactions. The
goal of studies of intra-cultural variation is to understand the relationship between individual
decision-making within the context of constraints provided by the superorganic whole
(Handwerker 2002). This is done by focusing on processes and mechanisms of individual
learning of cultural knowledge. This emphasis on micro-processes instead of typologies allows
anthropologists to determine how societies emerge from the combination of autonomous
individuals’ thoughts and actions and helps investigators better understand how social processes,
such as cultural change, work (Boster 1987).

Over the years cognitive anthropologists have developed an understanding of the culture
concept that accommodates intra-cultural variation while still including aspects of sharing that
are characteristic of cultural phenomena. They generally believe there are two types of culture,
one that is embodied in the individual and the other in properties of groups (Handwerker 2002).
The culture that exists within each individual is combined to form the group culture. Although
they accept that there are other aspects of culture, cognitive anthropologists believe the most
important aspect is located within the minds of individuals. As a result they believe culture
consists of knowledge, information (D'Andrade 1981, Goodenough 1964, Roberts 1964), or
shared cognitive representations of semantic structures (Romney and Moore 1998). Since
knowledge is an important aspect of culture, culture exhibits all the qualities of knowledge,
including its ability to be learned, received, created, shared, stored, retrieved, transmitted,
No one person has all cultural knowledge because there is too much for anyone to master
culture in different domains is a result of individual differences in cognition, emotion, behavior,
experiences, and relationships (Handwerker 2002, Romney, Weller, and Batchelder 1986, Tylor
The observable outcome of variations in mastery is that cultural knowledge is heterogeneously distributed within groups (Roberts 1964:439). Another property of individual culture is that over time it evolves through changes in experiences and interactions, which lead to evolution of group cultures (Handwerker 2002). Lastly, individuals do not participate in just one culture but instead in a variety of cultures (Sapir 1932). For example, physicians share a common body of knowledge, as do mothers, but participating in one of these cultures does not preclude participation in the other.

One aspect of culture, which is particularly important in understanding how it is distributed among individuals, is that it is learned. Various aspects of learning opportunities, such as quantity, quality, and distribution, can have a major impact on the degree of sharing of cultural knowledge between individuals and the pattern of cultural knowledge within a group (Boster 1991). This is especially the case for knowledge used in mundane activities such as farming practices and treatment of illnesses, whereas ritual and ceremonial behavior are more likely to follow norms (Pelto and Pelto 1975). Characteristics of learning opportunities can be affected by individual attributes of learners, relationships between individuals, and various aspects of the domain of knowledge, including how knowledge within that domain is learned and the level of abstraction of the items within the domain (Boster 1991). The systematic examination of the relationship between situational constraints and cultural knowledge and behavior can lead to a detailed understanding of micro-level processes of social systems, which can be used to understand the mechanisms and causal factors of sociocultural change.

Other aspects of the cognitive model of culture that are particularly important to studies of intra-cultural variation are 1) cultural knowledge resides within all individuals within a cultural group, 2) individual responses within a domain reflect their personal culture, and 3)
consensus among peoples’ responses reflects the overall group culture within that domain (Boster 1986, D’Andrade 1987, Romney, Weller, and Batchelder 1986). Boster (1986) was apparently the first researcher to identify the importance of consensus in identifying cultural knowledge of a group. Boster planted a garden with many varieties of manioc and asked Aguaruna women from Peru to identify the different plants by name. He found that individuals who had high agreement with others also provided the correct name to the manioc variety. In addition, he found that women who agreed most with the group gave more reliable responses when re-tested. These results show that agreement among respondents indicates cultural knowledge within a domain. Another study, performed by D’Andrade (1987), provides strong evidence that individual cognition is related to cultural consensus. He studied modal responses in domains with and without a single correct answer. He found that participants who agreed more frequently with the cultural consensus were more reliable, consistent, better educated, more experienced, had higher IQs, and gave their responses more quickly. He determined that these individuals were aptly considered experts within the cultural domain of interest. Some reasons why their responses were more similar to the shared responses of the group could be because of more-extensive and higher-quality learning opportunities, greater aptitude, and/or better teachers (Boster 1991, D’Andrade 1995). In addition, more extensive learning opportunities encourages experts to use modal terms understood by a large number of people (D’Andrade 1987). The use of common terms gave individuals communicative advantages that helped them develop their individual expertise and also helped maintain the cultural system by developing common ways to refer to items within domains, which then fostered sharing (Boster 1987).

Around the same time as Boster (1986) and D’Andrade’s (1987) respective studies, Romney and colleagues (1986) developed the concept of knowledge as consensus into a
mathematical model based on factor analysis called the cultural consensus model (CCM). The CCM produces individual competence scores that estimate the relative levels of individual cultural knowledge within a domain and it estimates the culturally correct answers to the questions posed.

The CCM was used in this study to determine if there is one common culture of herbal remedies and to measure the individual variation in relative cultural knowledge of medicinal plant remedies in Tabi. In addition, the first hypothesis was developed out of findings from empirical studies on the distribution of medicinal plant remedy knowledge that show the amount of sharing of herbal knowledge varies considerably between remedies (Barrett 1995, Casagrande 2002). Chapter 4 provides a more in-depth discussion of the relationship between the cognitive model of culture and the distribution of knowledge.

Representation of Knowledge-Sharing Relationships Using Social Network Analysis

SNA focuses on the patterns and implications of relationships between social entities (Wasserman and Faust 1994). This theoretical perspective helps answer a major social philosophical question: how are societies formed through the combination of individuals? (Borgatti et al. 2009). Although social network analysts were not the first to address this question, they are the only group that argues that social structure and relationships between individuals are the cause of behavioral outcomes, in addition to individual characteristics (Marin and Wellman 2010). Investigators using a social network perspective found traditional data collection and analysis techniques inadequate to measure the role relationships play in social phenomena. In response, they developed a distinct set of theoretical concepts and analytical methods to test their models. The development of SNA occurred through symbiotic advances in

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2This source is forthcoming however it is currently available at: http://www.chass.utoronto.ca/~wellman/publications/newbies/newbies.pdf
social theory, empirical research, and formal mathematics and statistics (Wasserman and Faust 1994).

The importance of relations in explaining patterns of behavior within society can be seen in the works of many sociological theorists including Comte, Durkheim, Marx, Weber, Goffman, Parsons, and Simmel (Emirbayer 1997, Marin and Wellman 2010). However, the development of the field of SNA did not begin until the 1930s when Moreno (1934) developed sociometry, a field that provides ways to measure interpersonal relationships, and sociograms, visual depictions of interpersonal group structure. Moreno succeeded in turning an abstract concept of social structure into something that could be measured and visualized. During the 1940s and 1950s, mathematical aspects of network analysis became further developed with the application of matrices and graph theory to represent network data and relational concepts, and to provide representations of social structure (Borgatti et al. 2009). In addition, research on networks expanded from mathematics into the fields of psychology, political science, and economics and focused on the representation and analysis of network structure. Prominent research projects consisted of laboratory experiments comparing the speed and accuracy with which different groups solved problems depending on their communication networks (Pool and Kochen 1978) and research addressing the “small world” problem, which asks how many acquaintances it takes to link two randomly selected people from a population. Milgram (1967) subsequently empirically tested the “small world” problem and determined there were “six degrees of separation” between two randomly selected people.

Anthropologists began using network analysis in the 1950s to help describe social organizations and complex societies because they were not able to understand the behavior of individuals using theoretical principles from the structural-functional approach (Barnes 1954,
Bott 1957, Mitchell 1974). In the 1970s sociologists developed structural equivalence, which are reduced models of networks where the nodes represented structural positions or roles (Lorraine and White 1971), and the development of the “strength of weak ties” theory (Granovetter 1973). By the 1980s SNA had a professional organization, an annual conference, specialized software, and its own journal, which helped established it as a field (Borgatti et al. 2009). Since the 1990s network studies have been performed in many fields, including physics, biology, management consulting, public health, criminal justice, and military science.

There are two broad categories of theories used in social network studies: those borrowed from mathematics and social psychology and those developed within the discipline (Kilduff and Tsai 2003). The most influential approach borrowed from mathematics is graph theory. Graph theory is useful in SNA because 1) it provides a vocabulary to describe properties of social structures, 2) it provides mathematical operations for quantifying the properties, and 3) it allows investigators to test hypotheses and prove theorems about representations of social structure (graphs) (Wasserman and Faust 1994). In addition, it allows researchers to model social systems, determine the mechanisms for the development and maintenance of social organizations, establish the effectiveness of social organization, and determine the means for easing conflicts (Krackhardt 1994). There are many different aspects of graph theory; the most utilized in social network studies are degree of connectedness, graph hierarchy, graph efficiency, and least upper boundedness. Degree of connectedness and graph hierarchy are particularly relevant to this study and are discussed more in depth further on in this chapter. Additionally, theoretical insights from two major social psychology theories, balance theory and social comparison theory, have been utilized, adapted, and broadened by social network analysts. Balance theory emphasizes the tendency of individuals to foster relationships between their friends. Investigators using this
theory to guide their research focus on ideas of reciprocity and transitivity in relationships and on clique dynamics. Social comparison theory focuses on the tendency of individuals to compare themselves to people with whom they have things in common. The principle of homophily, the tendency of individuals to associate with people who are similar to themselves, is an important aspect of this theory.

There are two main theories that have been developed within the discipline of SNA: heterophily theory and structural role theory (Kilduff and Tsai 2003). Heterophily theory broadly argues that new information is brought to a group through individuals who are members of other groups or who provide a link between two otherwise unconnected groups (Rogers 1995 [1962], Rogers and Bhowmik 1970). There are two particularly popular extensions to this theory: the “strength of weak ties” and “structural holes”. Granovetter’s (1973) strength of weak ties theory emphasizes the importance of weak ties between acquaintances in the flow of information between groups. In the structural holes perspective, Burt (2004) focuses on how individuals can improve their social capital by linking otherwise unconnected groups. The structural role theory focuses on how structural position influences the attitudes and behaviors of individuals (Kilduff and Tsai 2003). There is an emphasis on structural cohesion, structural equivalence, and role equivalence in this theory.

In addition to social network theories, there are two other aspects of SNA that are particularly important to this study. The first is the fundamental axiom of SNA, which is that social structure matters (Borgatti et al. 2009). When this is applied to the individual, it means that the individual’s opportunities and constraints are partly determined by their position within the network. As a result, variation in their knowledge and attributes can be explained to some extent by their network position. In addition, there are several theoretical mechanisms used to
explain the influence of social network variables including adaptation, binding, exclusion, and direct transmission. Direct transmission, or the flow of information from one individual to another, is the most common and pertinent mechanism to this study.

The two theories that were used in this study were graph theory and heterophily theory. Graph theory was used to characterize the structure of the medicinal plant remedy knowledge inquiry network and the positions of the individuals within the network (Borgatti et al. 2009). Various measures of the network were calculated including density, fragmentation, reachability, reciprocity, and centralization (Wasserman and Faust 1994). Individual position was measured using a suite of centrality measures including degree, closeness, and betweenness. Many studies found a positive relationship between centrality measures and power and influence (Brass 1984, Knoke and Burt 1983). The findings in those studies led to the development of the second hypothesis that there is a positive relationship between centrality measures such as degree and closeness and medicinal plant remedy knowledge. Heterophily theory was used to develop the third hypothesis related to the existence of communication between individuals within Tabi and elsewhere regarding medicinal plants. Graph theory principles related to network structure, such as degree connectedness and graph hierarchy, were used to explain, in part, relative knowledge levels of individuals. A more thorough explanation of the relationship between network analysis theories and the hypotheses tested is provided in Chapter 5.

**Hypotheses on Herbal Remedy Variation, Attribute, and Relational Variables**

Three hypotheses were developed and tested using the guidance of theories described in this chapter:

- **H1:** Some knowledge of herbal remedies is distributed widely among the community; but, more than 40% of the remedies are known by only one person.
• H2: Relative levels of herbal knowledge (cultural competence scores) are positively associated with the individual’s position (in-degree, in-closeness, and betweenness scores) within the medicinal plant remedy knowledge inquiry network.

• H3: The proportion of ties in an individual’s medicinal plant remedy knowledge inquiry network that are with people outside of the community are negatively associated with their relative level of herbal knowledge (cultural competence score).

**Conclusion**

Two major theoretical perspectives were used to guide this research project: cognitive anthropology and SNA. The aspect of cognitive anthropology that was of particular importance to this study was the cognitive theory of culture. In this theory, culture is defined as occurring, at least partially, in the mind and exhibiting the same properties as knowledge (e.g., learned, shared, stored, and lost). It also varies between individuals yet maintains some commonalities among members of a group, is dynamic and constantly evolving, and can be approximated through group consensus. The first hypothesis was developed out of research on herbal knowledge distribution, which shows that some knowledge is widely shared but the majority is idiosyncratic. Personal attributes explained some of the variation that occurs in individual herbal knowledge, attributes such as age (Begossi 2002, Phillips and Gentry 1993a), gender (Browner 1991, Camou-Guerrero et al. 2008, Voeks 2007), livelihood strategies (Pilgrim, Smith, and Pretty 2007, Quinlan and Quinlan 2007), formal education (Ohmagari and Berkes 1997, Zarger 2002b), range and migration (Casagrande 2002, Voeks and Leony 2004), religion (Caniago and Siebert 1998, Voeks and Leony 2004), relative economic prosperity (Benz et al. 2000, Pilgrim et al. 2008), lifestyle (Trotter and Logan 1986, Zent 2001), and individual talents and motivations (Krupnik and Vakhtin 1997, Quinlan and Quinlan 2007).

Since common cultural knowledge is mostly acquired through transmission between individuals, constraints and opportunities to acquire knowledge have been identified as influencing knowledge distribution (Carley 1986:399, Handwerker 2002:109, Marin and
Transmission of cultural knowledge occurs through social networks, which means that individual access to information is likely influenced by structural characteristics of the network and their positions within that network. Two theories from SNA were utilized to develop and test the hypotheses in this study: graph theory and heterophily theory. Graph theory was used to characterize the positions of individuals and the structure of the network of herbal remedy knowledge inquiry in Tabi. In addition, studies testing the relationship between position and access to knowledge guided the development of the second hypothesis statement. These studies showed that individuals holding more prominent positions tend to have access to more information, although this is somewhat dependent on network characteristics such as density and reciprocity of ties. Finally, the third hypothesis was developed from heterophily theory, which argues that individuals who have relationships with more groups have access to more diverse information. I predicted that people in Tabi who ask a higher proportion of people outside of Tabi about medicinal plant remedies will have more diverse knowledge. I hypothesized that there is a negative association between competence scores and proportion of ties to people outside of Tabi because competence scores are based on the proportion of matches in responses an individual has with the other participants in the study. In other words, it is likely that an individual with a high proportion of ties to people outside of Tabi will have distinct knowledge about medicinal plant remedies from those participants who only ask people within Tabi about herbal remedies and as a result they will have a lower competence score. This is assuming that medicinal plant remedy knowledge varies between communities in the state of Yucatan and that the majority of the participants only ask people living in Tabi about herbal remedies.
Although theoretical perspectives from cognitive anthropology and SNA are not commonly combined\(^3\), they are very complementary. Both seek to answer the question: how are societies formed from autonomous individuals? Cognitive anthropology does so by emphasizing the characteristics of the individual whereas SNA focuses on the structure of relationships between individuals. Neither perspective assumes that uniformly cohesive and discretely bounded groups exist (D'Andrade 1995, Marin and Wellman 2010), which means they are suited to study variation within cultural groups (Borgatti et al. 2009). Also, cognitive anthropology focuses on micro-level processes and mechanisms of individual learning (Boster 1987) while SNA allows researchers to explain macro-level patterns by describing how relationships between people within a social system shape individual knowledge (Marin and Wellman 2010). The combination of theoretical perspectives that focus on understanding at different scales helps develop a greater understanding of how social processes work and, thus, by combining the two perspectives, a more complete model is developed.

This study is of interest to the scientific community and is directly applicable to a broader audience because of its efforts to identify cultural knowledge and determine how to preserve it. Biological diversity provides humans options for plants that can be used for food, medicine, housing, clothing, transportation, fire, spiritual aspects, and aesthetics (Pilgrim, Smith, and Pretty 2007). Cultural knowledge about local environments, adaptation to environmentally related changes and disasters, and the local languages this knowledge is encoded in (Posey 2001) is also important because it provides information on how to solve a wide variety of environmental problems (Maffi 2001). The more information that is available from diverse cultures, the more options there are available to help solve societal problems. Research has shown that linguistic,

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\(^3\) See Boster, Johnson, and Weller (1987), Bott (1957), Reyes-Garcia et al. (2008b) for notable exceptions.
biological, and cultural diversity are strongly correlated with each other (cf. Maffi 2005). Their maintenance serves not only the local population but also humanity because it provides a diverse set of options to solve an increasing number and severity of environmental problems that threaten our very existence on this planet. Thus efforts need to be made to document and maintain linguistic, biological, and cultural diversity.

This dissertation consists of five more chapters. Chapter 2 focuses on the context of the study including the Yucatan Peninsula and Tabi. The biophysical, historical, and sociocultural issues that may influence medicinal plant knowledge are discussed. Chapter 3 focuses on the methodology of the study. It includes logistical information and the methods used to gather information in Tabi. The distribution of herbal knowledge in Tabi is emphasized in Chapter 4. In addition, the first and second objectives are addressed and the first hypothesis statement is tested. Chapter 5 concentrates on the variables known to influence individual variation in medicinal plant remedy knowledge. Also, this chapter focuses on the third objective and testing the second and third hypotheses. Chapter 6 includes a summary of the findings of this study, suggestions for future research to further understand variation in individual medicinal plant remedy knowledge, and the contributions that this study makes to anthropology, conservation, and ethnobotany.
CHAPTER 2
YUCATAN

Robert Redfield wrote two, now classic, ethnographic works about peasant life in the Yucatan. His first, *Chan Kom, A Maya Village* (1934), which he co-authored with Alfonso Villa Rojas, a teacher in Chan Kom, conceptualized Chan Kom as an idyllic autonomous folk society. Over a decade later Redfield returned to the village and discovered that the people of Chan Kom regularly came in contact with the outside world. His findings were published in *A Village that Chose Progress: Chan Kom Revisited* (1950). Tabi, like Chan Kom, has “chosen progress” in the sense that its residents are constantly in contact with those who do not reside there. Thus it is important to situate Tabi within its local, regional, and global context to better understand how and to what extent herbal knowledge is shared within the community today.

In this chapter the general context of the study is provided with particular attention to aspects of life that have the potential to influence the availability of herbal knowledge and its transmission in Tabi. The factors emphasized are integration of people from Tabi with the region and the world; the modification and use of the biophysical environment; historical resource use; social organization, distribution of labor, and economics; diet and health care practices; and religion and politics. Many of these same influences on knowledge distribution are discussed in Chapter 5; but, the scale is at an individual level whereas the scale presented here is coarser. The conclusion contains a brief explanation of why Tabi is a good community to help understand individual variation in knowledge.
Geographical Location of Study and Global Integration

Tabi is a small community (20°35’55’’N, 88°53’57’’W) in the municipality of Sotuta\(^1\) (Figure 2-1) in the state of Yucatan, the northernmost state in the Yucatan Peninsula of Mexico. The Yucatan Peninsula is separated from the rest of Mexico by the Gulf of Mexico, mountains, and long distances. This isolation fostered the development of a strong regional identity, which is very apparent when speaking to Yucatecos. Cuba has had an especially strong influence on the region because of its proximity and importance as a trade partner. Sotuta is the *cabecera* of the municipality by the same name; it is the political, commercial, and ceremonial center and the most densely populated of the communities in the Tabi area. The municipality consists of three *ejidos*, communally owned land, including Tabi. Yucatec Maya is the primary language of the members of the community of Tabi, but, according to the census by the Instituto Nacional de Estadística y Geografía (INEGI) (2005), everyone in the community also speaks some Spanish.

In addition to bilingualism, there are several other factors that suggest the Spanish influenced Tabi. The community was likely inhabited since before the time of the Spanish Conquest in the 16\(^{th}\) century. The enormous Catholic cathedral in the center of the community dates to the 18\(^{th}\) century and is a visible reminder that the Spanish perceived a need to exert their religious influence in Tabi; it also suggests that it was an important community during and after the conquest (Figure 2-2). Uninhabited walled terrains radiating from the center of the community provide evidence that Tabi was once a much larger village. This information, along with archaeological information that the Maya have occupied the Yucatan Peninsula for at least 3,000 years (McKillop 2004), suggests that the Maya of Tabi have been interacting with the local flora for a long time.

\(^1\) Municipalities are in the same position in the hierarchy of political divisions in Mexico as counties are in the United States.
Residents of Tabi generally produce their own food, although many of the youth migrate at least temporarily to cities within the region to participate in low-skill wage labor. In addition to providing jobs, regional cities are also important places to purchase low-cost goods and receive health care and legal services. Tabi is 95 km southeast of Merida, the largest political and commercial center on the Yucatan Peninsula with approximately 750,000 residents (INEGI 2005). It takes about two hours and costs 35 pesos (approximately $2.70–$3.50) each way to ride the bus that travels from Tabi to Merida and back once daily. Residents of Tabi generally take trips to Merida on an as-needed basis with most trips occurring as a result of health care needs and for employment opportunities. The frequency of the trips varies from every week for young women working as maids in private homes in Merida to once or twice a year for older individuals who do not have any family living there. These frequencies were much lower before the establishment of the paved road between Sotuta and Tabi in the late 1980s and the bus route from Tabi to Merida in 1996.

The availability and accessibility of scientific medical health care and pharmaceuticals has increased with access to nearby towns, such as Sotuta and Yaxacaba, and to Merida. In particular, the paving of the road to Yaxacaba, the cabecera of the municipality to the east of Sotuta, 15 years previously provided increased access to a popular self-taught medical doctor. In addition, construction of the Servicios de Salud de Yucatán (SSY) health center in Tabi 20 years previously and the permanent installation of a yearly rotating medical intern as a part of the pasante program in 2002 led to even greater physical access to scientific medicine (Figure 2-3). The state-run clinic is the main supplier of pharmaceuticals in Tabi. In addition, the six tiny privately owned stores and the government-run store sell very basic pharmaceuticals.

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2 He follows the scientific model of medicine however he was never formally trained in it.
Community members in Tabi have access to the Mexican government’s insurance for the poor and otherwise uninsured (Seguro Popular) and SSY facilities for free. Increasing physical access to scientific medicine and the relative ease of travel between Tabi and larger towns in the region exposed people in Tabi to the cash economy and a consumer-based lifestyle.

Electricity and media are other ways that people in Tabi obtain increasing access to the outside world. Reliable electricity became available in the late 1980s, which gave people access to television broadcasts; in the 20 years previous only gas-powered generators were available for very basic needs. Radios are the most effective way to bring news from other places to Tabi because almost all of the households have one. People listen to Yucatec Maya and Spanish broadcasts on a wide variety of issues including politics, crimes, accidents, deaths, employment opportunities, social events, health issues, and music from a variety of genres. Televisions are becoming more common and they provide people with access to soap operas, news regarding national and international events, and Hollywood movies. A little over half of households in Tabi have a television (52.52%), which is 35% lower than the average for the state of Yucatan (INEGI 2005). People often spoke to me about current events that were regional, national, and international in scope. A favorite topics was to criticize the former USA president George W. Bush’s international politics. Print media, such as books, magazines, and newspapers, are not as popular because of their relatively high cost, the low reading skills of most people, and the lack of availability; although newspapers and Bibles are common reading material for some in the community.

People living in Tabi are connected to places outside of their physical boundaries through reliable transportation, the media, and the installation of government institutions in their community, such as schools and the health care clinic. Reliable transportation and improved
roads allow people to move freely between Tabi and other locations. This movement and increased contact with individuals from different communities augments people from Tabi’s access to new information and ideas. The media also increases access to new information with the potential to influence people’s thoughts and behaviors. The people working at government institutions, such as teachers, nurses, and medical interns, are not from Tabi, and they bring different ideas into the community. Thus the increasing access to new information from individuals from outside of Tabi has the potential to influence the use and knowledge of herbal remedies.

**Biophysical Constraints on and Human Modification of Plant Resources**

Components of the biophysical environment, such as physical traits and climate, influence the type of vegetation that grows in any particular region. In the Yucatan Peninsula, variations in flora are especially related to an environmental gradient that runs from the northwest to the southeast (White and Hood 2004). The environmental gradient consists of factors such as soil type, drainage, and topography that are heavily affected by climate. The biophysical environment, in addition to constraining the vegetation that grows in the region, also restricts which plants are known and used as medicines because people tend to use the plants that are accessible and familiar (Logan and Dixon 1994, Voeks 1996).

The peninsula is composed of limestone deposited around 50 million years ago (Wilson 1980). Evidence of its geological roots can be seen everywhere in Tabi. Household compounds are constructed to take advantage of the flat rocky outcrops as foundations for houses and natural staircases between minor elevation changes. The soil in which maize, beans, squash, and other subsistence foods are cultivated exists in thin layers over the limestone and in the depressions that form by rain over time. The soils are generally young, thin, rocky, lime-rich, and permeable (Salvador Flores and Espejel Carvajal 1994, Weisbach, Tiessen, and Jiménez-Osornio 2002).
(Figure 2-4). Most farmers improve soil fertility by practicing slash-and-burn agriculture. The process of cutting down plant matter and burning it releases nutrients into the soil and allows crops to be grown for two or three years consecutively. The fields are then left fallow until the trees are large enough to repeat the process. Due to government programs and policies to modernize agriculture in Mexico and a reduction in easily accessible ejido land, some farmers create permanent agricultural plots where they enrich the soil with synthetic fertilizers, weed the plots using herbicides, and kill the insects with pesticides. Though done in Tabi, input-intensive production is not very common because even with government subsidies the cost is much higher than swidden agriculture; although they do produce more crops. In addition, some farmers have chosen to reduce their use of synthetic inputs because of the negative health effects they experience after using them. Another consequence of the rocky landscape is that all cultivation is manual.

In addition to soil, water is an imperative resource that affects the types of plants that can grow in an environment and the everyday functions of people there. The majority of the peninsula is flat with altitudes no greater than 100 m above sea level (Weisbach, Tiessen, and Jiménez-Osornio 2002); Tabi is no exception with an elevation of 24 m. There is very little surface water in the peninsula because of the permeability of the limestone rock and the flat land surface (Teran and Rasmussen 1994). Subterranean aquifers are the main source of water for the region and are replenished by surface precipitation (Brenner, Medina Gonzalez, and Zetina Moguel 1995). One of the most stunning landmarks in Tabi is the large cenote (sinkhole) that exists in the center of town (Figure 2-5). Cenotes are very common, especially in the state of Yucatan, and are a way for people to gain access to water. Another way is through digging wells. In Tabi, people drew water from wells and cenotes for all their household needs until running
water was installed in the community approximately 20 years previously. Due to difficulties in accessing water fields are not irrigated.

There are two seasons in the peninsula that are determined by the amount of rainfall. The rainy season runs from May through October. The almost daily afternoon rains are very much appreciated by all because they help to relieve the stifling heat and water the crops. There is one crop cycle per year because there is not enough rain in the dry season to sustain crop production; approximately 80% of the 1,137 mm (44.76 in) of rain that falls on average each year in Sotuta falls during the rainy season (Duch Gary 1988). During the dry season it becomes difficult to find some of the ephemeral medicinal plants. As a result people use substitutes that withstand the lack of water or gather and dry plants that disappear in the dry season at the end of the wet season. In addition to rainfall varying seasonally, it also varies along the environmental gradient (Duch Gary 1988). At the northwest corner of the peninsula, rainfall averages 400 mm (15.75 in) per year and at the southeast it averages 1,900 mm (74.80 in) per year. Tabi is located midway along the rainfall gradient.

Unlike rainfall, temperature does not vary much temporally or spatially within the peninsula. The climate is considered semi-humid and warm with summer rains (Aw0 according to the Köppen climate classification) (Duch Gary 1988). The climate is a frequent topic of discussion in the Yucatan. Almost every time I express my love for the state to a Yucateco they respond, “But what about the heat? Do you love that too?” Their comments were made with good reason as the average temperature for the year is 26.7°C (80°F) in Sotuta with a range from 29.6°C (85.3°F) in May and 23.2°C (73.8°F) in December (Duch Gary 1988). In addition, the average high in May, the hottest month of the year, is 37.3°C (99.1°F). Even though temperatures are generally warm, the nights in December average 16°C (60.1°F). In Tabi people
are more affected by the cold weather than the heat. Many a night in December I went to bed early and shivering in my hammock because of the lack of protection the housing provided from the elements. Throughout the peninsula the average yearly temperature ranges from 25°C to 28°C (77-82.5°F) (Salvador Flores and Espejel Carvajal 1994). Thus Tabi’s temperature is right in the middle of that range.

Hurricanes are another climatic event that affects the vegetation in Tabi and throughout the peninsula. Hurricanes are common from August to October when the dominant winds are from the east and southeast (Salvador Flores and Espejel Carvajal 1994). In November the winds shift and the stronger winds come from the north (Duch Gary 1988). Although Tabi is far from the coast, crops and other useful plants were destroyed several times by heavy winds and rains associated with hurricanes. In summary, the warm and humid climate that is found throughout most of the peninsula, including Tabi, is a result of the Yucatan Peninsula’s sub-tropical latitude, proximity to large warm bodies of water, wind currents, and flat landscape (Teran and Rasmussen 1994). All of these factors contribute to the creation of the biological resources available for human use.

The varying geophysical properties throughout the peninsula help to form the 16 major types of vegetation, which include several types of coastal vegetation, deciduous forest, perennial forest, and savanna (Salvador Flores and Espejel Carvajal 1994). The most common vegetation types are low deciduous, medium semi-deciduous, and medium semi-perennial forest. In general, the geological age, complexity, and height of the vegetation types follow the environmental gradient. The forest surrounding Tabi is considered low deciduous forest (Salvador Flores and Espejel Carvajal 1994; Figure 2-6). As the name of the type of forest suggests, almost all of the trees lose their leaves during the dry season (Figure 2-7). The trees in
the forest are between 6 m (19.69 ft) and 15 m (49.21 ft) tall and 10 cm (3.94 in) and 30 cm (11.81 in) in diameter at breast height when fully mature (Salvador Flores and Espejel Carvajal 1994). Like most of the Yucatan Peninsula, the vegetation in this area is dominated by species in the legume family (Salvador Flores and Espejel Carvajal 1994). Some common species from other families are *Caesalpinia gaumeri* Greenm. (Fabaceae), *Diospyros cuneata* Standley (Ebenaceae), and *Jatropha gaumeri* Greenm. (Euphorbiaceae) (Teran and Rasmussen 1994).

There are approximately 2,200–2,300 native and introduced plant species on the peninsula (Arellano Rodríguez et al. 2003, Ibarra-Manriquez et al. 2002); almost all of these species have common names and at least 2,150 are considered to have some sort of utility (Arellano Rodríguez et al. 2003). Endemic species make up 7.3% of the total number of species (Duran, Trejo-Torres, and Ibarra-Manriquez 1998) with a large number of them along the northern coast (Salvador Flores and Espejel Carvajal 1994). Diversity is high in the region because it serves as a bridge for species between Central Mexico, Florida, the Caribbean, Central America, and Northern South America (Arellano Rodríguez et al. 2003). The diversity in plant species generally follows the environmental gradient with more species in the southeastern portion of the peninsula.

Like the majority of the peninsula, throughout history the forest surrounding Tabi has been highly modified through the practice of swidden agriculture and charcoal production. Thus the amount of floristic diversity in the Tabi’s *ejido* available for medicinal use is likely much lower than the total reported for the peninsula. The modification of the landscape is especially apparent along the main road, which is dotted by *milpa* and vegetation in various stages of fallow. Other areas surrounding the village have similar landscapes, although the trees tend to be taller because of more difficult access and farther travel distances, which make the areas undesirable for
milperos\textsuperscript{3}. In addition, fallow periods are reducing in Tabi, much like other areas of the Yucatan, because of increased population density and decreased productivity of the land. The decrease in fallow period has resulted in a more extreme modification of the landscape than experienced in the recent past.

A story told to me by a milpero highlights the growing pressure on the forest surrounding Tabi. He told me that he had been letting a forest plot of 2 ha grow for over 20 years. He had his bees in the center of the plot so they were able to make honey with the pollen and nectar from the flowers on the trees. For 20 years the other ejiditarios\textsuperscript{4} respected what he was doing and did not bother the plot of land. Recently the milpero’s nephew cut down many of the trees in the plot to make charcoal. He told his uncle that he did not need that much forest for his bees and that he needed the trees to make charcoal to sell so he could feed his family.

Another substantial human modification to the environment was the introduction of useful Old World plant species. Introduced plant species are everywhere in the Yucatan. One of the most popular ornamentals throughout the region is the flamboyant tree (\textit{Delonix regia} (Bojer ex Hook.) Raf.), a native to Madagascar. In addition, the juice of the sour orange (\textit{Citrus aurantium} L.), a native of Southeast Asia, is an essential component to many Yucatecan dishes. Non-natives are also used frequently as medicine; for example, oregano (\textit{Origanum vulgare} L.) and rue (\textit{Ruta graveolens} L.) are two commonly used culinary and medicinal herbs from the Mediterranean that are also used as medicine on the Yucatan Peninsula.

In general, participants told me about remedies they use themselves. In addition, all of the common medicinal plants used to test levels of knowledge in this study are available locally.

\textsuperscript{3} Men working the \textit{milpa}

\textsuperscript{4} Members of the \textit{ejido}
Thus the knowledge people shared with me was generally limited by the plants that were available in the area surrounding Tabi, which are constrained by the biophysical environment, natural disasters, and human modification. There was a tendency for people to provide information about medicinal plants that grow within the village (Figure 2-8), along the roadside, and along trails to *milpas* (Figure 2-9). Therefore the common knowledge focuses on medicinal plants that thrive in disturbed environments or on plants cultivated for consumption or medicinal use. The importance of the forest as a source for commonly used medicinal plants appears to be minimal, although there is evidence that people transplant especially useful medicinal plants from the forest into their home gardens for convenience. These are similar findings to studies performed in Chiapas and North America (Stepp and Moerman 2001). In addition, people do not always take care of medicinal plants within the *ejido* so transplanting is a good way to maintain the population. One of the curers complained that sometimes people cut down the trees she uses for medicine and when she protests they tell her it is not her private property. Unfortunately, transplanting is not always successful. The same curer emphasized that “every plant has its area; they do not grow everywhere,” meaning the conditions within the home gardens are not conducive for every plant found within the *ejido*. Thus a concerted effort needs to be made to conserve medicinal plants in their natural habitats.

**Sociocultural Factors and Herbal Knowledge**

Sociocultural factors provide constraints and opportunities for acquisition and dissemination of TEK. This section focuses on five main factors: recent history of natural resource use; social organization, division of labor, and economics; diet and health care; language and education; and religion and politics. The information in these subsections is mostly based on a review of the literature, observations, conversations held with members of Tabi, and structured interviews.
**History of Natural Resource Use**

The first evidence of the Maya people on the Yucatan Peninsula are pottery vessels from 1,000 BC (McKillop 2004). Early Maya were sedentary farmers with an reportedly egalitarian political system (Henderson 1997). As the Maya political system developed in complexity, so did their agriculture. Agricultural practices were region-specific and frequently combined long-fallow swidden and intensified agriculture (Fedick 1996). Sunken *rejolladas* (dry sinkholes) provided moist and sheltered eco-niches ideal for agricultural production, raised fields in swampy areas satisfied the dual purpose of agricultural production and fish harvesting and allowed for year-round crops, and terracing was used to catch fertile soils and allowed for cultivation in otherwise unarable land. Ancient diets included maize as the staple, along with beans and squash (McKillop 2004). Avocado, native palms and other wild fruits, and chocolate were all used for subsistence. In addition, white tailed deer, peccary, mollusks, and fish were a part of their diet.

Although there is not much information on medicinal plants in the archaeological record, there is evidence of their use by the Ancient Maya in texts written shortly after the conquest (Azapalo 1995, de Landa 1978 [orig. 1556], Dillinger et al. 2000). *The Chilam Balam of Sotuta, Mena, and Chumayel* volumes of the *Chilam Balam*, the *Codex Pérez*, *The Ritual of Bacabes*, and the *Codex of Calkini* were all written by indigenous authors in the 16th century (Garcia, Sierra, and Balam 1999). Some of these texts are believed to be based upon ancient Maya hieroglyphic texts and others make reference to prehispanic life. The texts cover various issues related to Maya medical knowledge including orations and the invocation of gods for healing, the temporality of illnesses, and medicinal plant recipes.\(^5\)

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\(^5\) There is a more in-depth description of the evidence of Pre-Columbian Maya medical knowledge in chapter four.
A major transition occurred between the Classic and Post-Classic periods because of warfare as a result of status rivalries and long-distance trade; strain on resources because of high population density, growing burden of elite consumption, construction, and ritual; and climate changes and drought (Demarest, Rice, and Rice 2004). These factors lead to a decline in population and a reduced need for intensive agriculture. Slash-and-burn agriculture once again became the dominant practice (McKillop 2004). After the conquest the Spanish and Creole elite gained control of much of the indigenous lands (Hamnett 1999). In the mid-1800s the landowners in the state of Yucatan started producing henequen (*Agave fourcroydes* Lemaire) for export. Many of the Maya became indebted laborers on monoculture henequen plantations (Carmack, Gasco, and Gossen 1996). In 1911 the henequen market crashed mostly due to the development of synthetic fibers. The Mexican government, however, continued to subsidize henequen production into the 1980s. Large-scale production of henequen had devastating effects on native vegetation in the Yucatan that can still be seen in the short scrubby nature of the forest. In addition, people living in the henequen zone describe loss of knowledge related to traditional agricultural practices as a result of henequen production. Tabi was outside of the periphery of the henequen zone and as a result was little affected by the industry. The closest place where henequen was produced and processed was Huhi, which was too far away for people from Tabi to work there.

One result of the Mexican Revolution (1910) and the drastic modification of the constitution that followed was some land rights were removed from the Creoles and given back to the peasants (Carmack, Gasco, and Gossen 1996). Peasants in Tabi, like many other parts of Mexico, benefited from this land reform. The land was redistributed into communally owned *ejidos* but management varied from collective to individual (Brown 1997). In collectively
managed ejidos, members worked together and shared what they produced. The more common form of management was individual usufruct, where *ejido* commissioners gave individuals the rights to work and benefit exclusively from the products of a plot of land within the *ejido*. In addition, the rights to the parcel of land could be inherited patrilinearly (Stephen 1994) but the parcels could not be rented, sold, or mortgaged (Brown 1997). *Ejido* land is communally owned in Tabi and individual fields and young fallow are managed as usufruct property. Once a farmer is no longer working a plot of land, another *ejiditario* can occupy it. The Institutionalized Revolutionary Party (PRI) was created to guide Mexico through the post-revolution process of development. The PRI believed that development could best be accomplished through industrialization, political reform, and nationalism (Carmack, Gasco, and Gossen 1996). Unfortunately, the party became authoritarian, corrupt, repressive, and heavily indebted to industrialized nations. The 1970s brought some relief from foreign debt through the discovery of oil reserves and the diversification of the economy. In the 1990s the Mexican government implemented several neoliberal policies that intended to bring free market benefits (Anderson, Faust, and Frazier 2004) and modernize agriculture through intensification and privatization (Klepeis and Vance 2003).

Although small-scale slash-and-burn agriculture continues to be widespread in the Yucatan, as a result of the government’s neoliberal policies there has been an increase in large-scale agriculture projects focusing on rice, sugar cane, and citrus production, along with cattle ranching (Anderson, Faust, and Frazier 2004). Although large-scale agriculture has not developed in Tabi, there have been some visible impacts from the government policies. For example, raising cattle was common before the policies were implemented. People fenced in their *milpas* and let the cattle roam around the forest. Then the government passed a law stating
that people had to corral their cattle on private property. Unable to afford to buy land to make the
corrals, many people were forced to sell the majority of their cattle. Also as a result of the
policies, some individuals intensified their agricultural production through the use of chemical
fertilizers, pesticides, and herbicides. This practice may have dire effects on medicinal plants that
thrive in traditional milpa environments. Although some people in Tabi perform intensified
agriculture, the majority continue to practice slash-and-burn. Medicinal plant populations may be
negatively affected by this practice as well because of shorter fallow periods and increased area
of cultivation. Other subsistence practices common in Tabi are bee keeping, charcoal production,
and animal husbandry.

In recent years many producers shifted from a subsistence production system to a semi-
subsistence and semi-market production system (Vance 2004). People in Tabi participate in a
mixed production system; they often sell honey and charcoal and they sometimes sell surplus
animals. Very infrequently they sell maize or other crops; on the contrary they often buy staples
because they are unable to produce enough to feed their families. Privatization of ejido lands has
also become common throughout the peninsula, although Tabi’s ejido remains common
property. If Tabi’s ejido were to become privatization it may lead to decreased access to
medicinal plants.

Over the last 30 years the rise of tourism, the end of government subsidies for those
participating in the henequen industry, and other agrarian reforms resulted in considerable
migration (both temporal and permanent) from rural areas to regional urban centers to find work
in the construction and tourism industries (Re Cruz 1996). Migration to the United States is also
increasingly common. Traditionally the peasant Maya identity and worldview was defined by the
customary labor roles of working the milpa and growing maize for men and turning maize into
tortillas for women (Re Cruz 1996). Currently many Maya communities are struggling with newly emerging class differences and are being forced to redefine what it means to be Maya (Re Cruz 1996). Although temporary regional migration occurs in Tabi, class struggles are not yet common, likely because almost everyone in the community still relies on producing their own maize for subsistence. The influence of modernization is apparent in the decrease in prestige of herbal remedies and the preference for scientific medicine among those who have money. Regardless of modernization, the majority of people in Tabi continue to utilize medicinal plants as a part of their primary health care (Ankli 2000, Balam Pereira 2003, Méndez et al. 2003).

There is some continuity between the herbal knowledge that exists in Yucatec Maya communities today and the knowledge of the past. The evidence is the overlap in remedies described to me during this research in Tabi and the remedies described in colonial and 20th century texts. In addition, the remedies that older members of the community learned in their young adult years were similar, although greater in quantity, to the knowledge the younger community members possessed. This continuity can be attributed to the long history the people of Tabi have in that community. The ancestors of those living in Tabi had at least 300 years to develop herbal remedies with the available plants. In places that people have inhabited for long periods of time, knowledge is generally acquired through transition from parent to offspring (Casagrande 2005). This is likely what happened in Tabi over the generations and explains why some continuity of knowledge through time was observed.

**Social Organization, Division of Labor, and Economics**

Tabi is a small but growing village of 698 inhabitants. The inhabitants live in 122 different households on yards separated by stone fences. Households generally consist of nuclear families; however, in 20.5% of the cases, extended family lives on the same yard. Of the households where extended families live together, it tends to be grandchildren living with grandparents while
their parents live and work in urban centers or recently married couples living with the husband’s parents until they are able to gather enough resources to build their own house. Couples tend to live with or near the husband’s parents once they are married. The average household size is six people but ranges from one to 15 people. This figure is a bit greater than the average of approximately four people per household in the state of Yucatan (INEGI 2005). Since medicinal plant acquisition usually occurs informally during the course of daily life, people tend to learn about herbal remedies from people with whom they live (Casagrande 2002). When acquisition occurs during childhood, parents are often critical sources of knowledge (Casagrande 2005, Lozada, Ladio, and Weigandt 2006). In-laws may become important sources when the bulk of learning does not occur until adulthood, as is generally the case in Tabi. Women in Tabi especially utilize in-laws as sources of information because of the patrilocal living arrangements.

The housing compounds typically consist of two buildings, a kitchen, and a dormitory. In some cases there is more than one dormitory, especially when more than one nuclear family lives in the compound (Figure 2-10). The traditional dormitories are oval with no windows and a door in the front and the back. The frame of the structure is made out of wooden poles. Roofs are thatched or covered with an aluminum laminate. The walls tend to be constructed in two parts; the lower portion is created from small pieces of rock fitted together, and the upper portion is formed using vertically positioned sticks with grasses and mud used to fill the crevices. The surfaces are covered with a plaster for a smooth finish. In most houses the floors are concrete thanks to a government health program that provided the materials, although traditionally the floors were dirt. The kitchen is often a less elaborate version of the dormitory. The walls usually consist of sticks without any mortar, and in many cases the floors are still dirt. In addition to having a traditionally constructed dormitory, many compounds have a small rectangular block
house (Figure 2-11). The materials for these houses were donated by a government organization called FONDEN. A few families have larger houses constructed out of block or stone. Fully functioning bathrooms are scarce in Tabi and only 2.9% of households have septic systems, which is much lower than the 69.1% average for the state of Yucatan (INEGI 2005). Along with building materials, FONDEN donated bathroom fixtures, but most people sold them. People typically prefer to use the solar, a remote area in their yard enclosed by a stone wall, to take care of their excretory necessities. Bathing generally occurs within the dormitory, in the space within the FONDEN houses that was meant to be occupied by the bathroom, or in a small separate structure specifically built for bathing.

There are various aspects of the housing conditions just described that foster illness and injury. Mosquitoes, cockroaches, mice, rats, and other disease-carrying pests easily enter living quarters through cracks and windows and under doors. Poisonous creatures, such as tarantulas, scorpions, and snakes, are also frequently found in houses. I resided in a block house and often had cockroaches, mice, and scorpions sharing my space. I also had the occasional tarantula that I was taught to extract with care. I heard one story about a snake falling from a thatched roof onto a sleeping man; fortunately it was not poisonous. I also saw a poisonous snake curled up under a wardrobe in a block house. Skin ailments are not frequent in Tabi likely because of the general practice of bathing daily. Of the skin issues that exist, most of them are a result of the hot climate. The design of the traditional huts keeps temperatures cool during the heat of the day, but in the cold winter nights they are drafty and can provoke respiratory infections. Also, the lack of any form of containment or treatment of human excrement results in contamination of the soil and water leading to illness.
Most yards are teeming with useful plants. Fruit trees are the most common, but horticultural plants, such as vegetables, medicinals, and ornamentals, also exist to varying degrees. Home gardens are the most common location for acquisition of common medicinal plants in this study and are important sources of medicinal plants in other parts of the Yucatan Peninsula (Anderson 2003, Rico-Gray, Chemas, and Mandujano 1991) and around the world (Rao and Rajeswara Rao 2006). Furthermore, a wide variety of animals are raised in many housing compounds. Chickens are the most common, along with turkeys, doves, and Mexican hairless pigs. In a few cases people have domesticated “American” pigs, sheep, and cattle living within their yard. The smaller animals are generally allowed to roam free, although they are discouraged from going near the horticultural plants. The larger animals are generally tied to trees. Most households (91%) (INEGI 2005) receive water pumped from the village well through pipes to the households twice a day for several hours at a time. The water is chlorinated by the village water manager and most people use it for all their water needs, including drinking. In a few households people buy purified water for drinking. Even though the water is treated with chlorine, it is not free from harmful microorganisms as I found out myself when I had severe and persistent diarrhea from consuming it. In addition to foreigners, children in Tabi are also prone to diarrhea, which is probably a result of consumption of contaminated water and exposure to contaminated soil. Adults frequently have problems with kidney stones, which they attribute to the sediment and chlorine in the water. Many herbal remedies for diarrhea and kidney stones are known and used in Tabi.

There is a distinct gendered division of labor in Tabi. Adult women are almost exclusively housewives, and the majority (89%) of the adult men work in milpa. Labor is divided more by location than by task. Women are responsible for all the activities that occur within the housing
compound while men are responsible for activities in fields or forests. The main roles of women are to prepare food, wash clothes, raise children, raise small yard animals, and tend home gardens (Figure 2-12). Many women also sew. Men carry out all activities related to the milpa. Some men also tend bees, produce charcoal, and raise cattle (Figure 2-13). In many households both men and women weave hammocks. The vast majority of daily activities are highly labor intensive. Village women cook all their meals from scratch on firewood and at least two-thirds of them wash all the clothes by hand. In the state of Yucatan, twice as many households have washing machines than in Tabi (INEGI 2005). Children are fairly self-sufficient at an early age and often help their parents with the chores. The gardening and crop cultivation is all done without the assistance of machines or irrigation systems. Cattle are constantly being moved to different grazing areas. Most other farm animals are fed maize kernels, that are removed by hand from cobs twice daily.

Gender is often found to affect the distribution in medicinal plant remedy knowledge in societies with gendered divisions of labor. The most common model to explain gendered variation in knowledge is the social role model. This model states that since women are generally responsible for taking care of their children they know more about herbal remedies because they learn about them to treat their children when they are sick (Arias Toledo, Colantonio, and Galetto 2007, Camou-Guerrero et al. 2008, Caniago and Siebert 1998, Pilgrim, Smith, and Pretty 2007, Quinlan and Quinlan 2007, Voeks 2007). This model, however, does not take into consideration the timing of knowledge acquisition. If children acquire medicinal plant remedy knowledge before their tasks become divided by gender, then their knowledge will not vary by gender (Lozada, Ladio, and Weigandt 2006).

6 I lived with a five-year-old who required minimal adult supervision. She was able to carry out many chores including washing her clothes on her own or with assistance from older children.
The majority of production activities in the village are for consumption or for sharing or sale within the community. For example, if someone kills a pig, they often share it with other villagers or sell a portion of it. Almost 75% of households do not have refrigeration compared to 30% in the state of Yucatan (INEGI 2005); therefore most animals are killed or plants are harvested for consumption on an as-needed basis. Some techniques, however, are used to preserve meats or grains, such as smoking or drying, respectively. Honey and charcoal are the only two products generally sold to people outside of the village. To provide some economic assistance to their families, many young women work as maids in regional urban centers. Essentially all women quit their jobs once they marry and return to the village to raise their children. There is only one married woman in the village who works outside of Tabi; however, her children are all grown and no longer live with her. Some of the men (30%) have temporary or permanent jobs in the regional urban centers. The most common job is block layer or an assistant to a block layer; although, some have jobs as diverse as car mechanic, heavy-equipment operator, assistant to a furniture maker, septic system installer, and pork rind processor.

Even though reliance on the market economy is minimal in Tabi, villagers participation in it still may influence knowledge about herbal remedies. Economic prosperity is often correlated with a decline in medicinal plant remedy knowledge (Benz et al. 2000, Pilgrim et al. 2008). The explanation frequently given is that individuals working in the market economy no longer spend as much time in nature or have as much time to learn about medicinal plants, and they have access to money to purchase pharmaceuticals and pay for visits to scientific medical doctors (Gaskins 2003, Voeks and Leony 2004). When cash incomes are unreliable, however, medicinal plant remedy knowledge is likely to continue to be useful and to be shared, as is the case for most people living in Tabi.
The Relationship Among Diet, Illness, and Treatment Choice

Malnutrition is a problem for subsistence farming families around the world (UNICEF 1998) and Tabi and other communities in the Yucatan are no exception. A longitudinal anthropometric assessment of nutritional status was done on children in Yolcaba, a rural community in the state of Yucatan (Leatherman and Goodman 2005). Data were gathered in 1938, 1987, and 1998 and the results showed that the average growth for children of different ages has increased over time. However, the growth rates still indicate a high rate of mild to moderate malnutrition as a result of low protein and/or micronutrient consumption. Insufficient quantities of food, micronutrients, and protein along with high parasite loads and infections frequently contribute to a high frequency of malnutrition in children (UNICEF 1998). Diets deficient in vitamins, minerals, and proteins can lead to poor growth, reduced mental development, and illness (Neumann, Harris, and Rogers 2002). Leatherman and Goodman (2005) measured nutrient intake in Yolcaba and found that families relying on their own food production and irregular wage labor may be experiencing deficiencies in vitamin A, vitamin Bs, vitamin E, and zinc. According to the medical intern in Tabi, many children show evidence of poor nutrition. Mothers with infants who have been identified as malnourished are given the opportunity to enroll their babies in a nutrition program sponsored by the state government and implemented by the local medical personnel. Many of the children, even after participating in the program, never reach a normal weight for their age, suggesting that their diets are either low in quantity or of poor nutritional quality. One practice that may lead to malnutrition in babies is the practice of feeding them exclusively on breast milk even after they have turned a year old. Mothers often told me that the doctor urged them to feed their babies solid foods in addition to breast milk. Although breast feeding is good for infants because it provides them with antibodies to fight infection and energy to grow, once an infant reaches five to six months, breast milk
should be supplemented with foods to help eliminate iron deficiencies and to help foster growth and development (Formon 2001). Medicinal plants are frequently used to treat illnesses associated with malnutrition such as diarrhea (Guerrant et al. 1992) and infections (Stephenson, Latham, and Ottesen 2000, UNICEF 1998). Thus there may be an association between prevalence of these illnesses and knowledge about medicinal plants used to treat them.

In the following description of the diet in Tabi there are a few notable aspects that could lead to malnutrition and illness, including the lack of vegetables, especially leafy greens, and dairy products. The Yucatec Maya diet is heavily dominated by maize in the form of handmade tortillas. Tortillas are generally made and consumed at all three meals of the day. Breakfast is usually eaten around dawn. The adults tend to eat leftovers or eggs and tortillas. Children eat cereal, sweet bread, or cookies. Almost everyone drinks coffee. Some people drink atole, a warm drink prepared with maize flour and warm water. In the mid-morning, many men drink pozole, a drink made of coarsely ground maize mixed with water, while they are working in the milpa. The main meal of the day is served between 12:00 and 14:00 h. In the poorer houses, this meal often consists of black beans and/or eggs and tortillas. In more wealthy houses a variety of dishes are prepared. Eggs and black beans are considered “fast food” and are prepared on days when the women in the household are extra busy. Many common dishes, such as keh chak and puchero, are broth based. Keh chak is venison or beef in broth and puchero is turkey in broth with noodles and a variety of vegetables, such as carrots, squash, and potatoes. Both dishes are garnished with radish and cilantro in sour orange juice. Puchero is most frequently prepared in households with members working in Merida because they are able to purchase the vegetables at the main market at low prices compared to the market in Sotuta. Many people do not have extensive vegetable gardens in Tabi; the reason I was frequently given was that the dooryard animals would eat the
plants. *Frijol con puerco*, another common dish, consists of chunks of pork served in black beans and adorned with the same garnish as the other dishes. The preferred drink during the main meal is carbonated beverages, although people settle for water when there is little money. Dinner is usually eaten between 19:00 and 21:00 h. Leftovers, dried pork or venison, sandwiches, hot dogs, quesadillas, or sweet bread are common dinner fare. Most people drink coffee or hot chocolate with this meal.

The scarcity of vegetables and dairy in Yucatec Maya diets may be especially problematic for children in households with short supplies of food because children are often given last priority in the distribution of food. One common practice of children that combats hunger and malnutrition is that they often snack on fruit found in yards. In addition, a government-funded after-school lunch program provides low-cost lunches for elementary students to help increase their caloric intake.

Another diet-related factor that hinders growth and development in children and fosters obesity in adults is the increase in consumption of high-calorie but nutrient-poor snack foods and drinks (Leatherman and Goodman 2005). Soft drinks are staples at many mid-day meals and celebrations. Additionally, children buy and consume junk food daily from the small stores in Tabi. On occasion I would go to Costco in Merida and bring back a large container of cookies or suckers for the family with which I was living. I was always amazed at the appetites of the children and adults alike.

Consuming of food in excess and focusing on taste with little regarding for the potential negative health consequences are other practices that may have ill health effects. One example of excessive consumption practices are the quantity of tortillas that are eaten. Adults typically consume between eight and 15 tortillas at the main meal of the day with little regard to weight
gain. One summer I ate an unlimited number of tortillas and gained 10 pounds. I isolated tortillas as the cause of my weight gain, reduced the quantity I consumed to one or two, and lost the weight. A poignant example of the preference for fatty foods by people in Tabi is their partiality to the consumption of Mexican hairless mini pigs compared to the American pigs (Figure 2-14). I learned that they like the native pigs better because they have more fat, which makes them more flavorful. Lard is used to cook almost every dish. The woman I lived with said she hardly ever uses vegetable oil because it tastes fishy to her. The outcome of the preference for fatty foods, excessive food intake, and consumption of junk food and hyper-sweet beverages is obesity (Leatherman and Goodman 2005). The health consequences of obesity are heart disease, stroke, and type II diabetes, all of which are fairly common in Tabi. Herbal remedies are not believed to be effective at treating these illnesses so it is not likely that an increase in their prevalence will lead to an increase in use and transmission of herbal knowledge. On the contrary, individuals who develop these illnesses may become accustomed to scientific medicine believed to be more effective in treating obesity related illnesses, which may reduce their reliance on and transmission of medicinal plants.

Foods consumed at the frequent celebrations in Tabi are good examples of the flavorful, fat-laden, and energy-rich foods preferred by Yucatec Maya. *Relleno negro* and *boot* are two dishes that are especially popular for celebrations. Both are turkey meat served in a sauce. *Relleno negro* sauce is from burnt hot peppers and other spices. *Boot* sauce is a white sauce made from the maize dough used to make *tamales*. Hard-boiled eggs often accompany turkey in the *boot* dish. Spaghetti and *Cochinita pibil*, pulled pork made with achiote sauce and cooked in an underground oven, fashioned into tacos are mainstays for large functions. *Tamales* are also
common celebration foods. *Tres leches*, a cake made with three kinds of milk, is purchased from a baker in Sotuta for very special functions.

Some illnesses provoked by poor diet and poor water quality may lead to increased transmission of herbal knowledge, especially in the case of illnesses perceived to be effectively treated with medicinal plants. Access and preference for different types of health care, however, also influence the potential for dissemination of herbal knowledge. Several health care options are available to people in Tabi who become ill, including home treatments or assistance from a relative or friend, or visiting a doctor or a traditional healer. The most popular option to cure common illnesses is home treatment (66.4%), visiting a doctor lagged somewhat behind with 28.4%, 3.4% preferred to visit a family member for assistance, and a mere 0.9% visited a curer or did nothing but trust in God’s will to treat a common illness. Self treatment can be done with medicinal plants or pharmaceuticals; 69% of people preferred to use medicinal plants rather than pharmaceuticals to treat common illnesses. The general level of interest in medicinal plants was high with 94% of the population professing an interest and 89% reporting the use of medicinal plants to treat common illnesses in their families.

The government-run health care clinic is free to all members of the village and while there is a pharmaceutical dispensary, it is not consistently well stocked. One woman blamed her last pregnancy on the clinic running out of birth control pills. Others, including the medical intern, told me that the medicines at the clinic are weaker than those sold at privately-run pharmacies; perhaps because they are expired or diluted. Overall there is a lack of trust in the care offered by the clinic; almost 50% of the population preferred to go to private clinics or hospitals in Yaxcaba, Sotuta, Tigre, Tixcacal, and Merida even though they had to pay for the consult, the

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7 These figures serve as a general gauge of treatment preferences, however, they do not address the nuances of treatment decision-making for specific illness events.
medicine, and the transportation to and from the location. Dr. Nacho\(^8\), a self-taught medical
doctor who practices in his clinic in Yaxcaba, is an especially popular choice with 40% of the
community seeking medical attention from him. He has been practicing medicine for a long time
in the area, so people in Tabi trust him to treat their families’ illnesses. There are three male
herbalists in Tabi with only one of the three still physically able to collect plants. There is also
one female herbalist. There are no *hmeen* (Maya priests) in Tabi, although there is one in
Yaxcaba. Additionally, there is one midwife who attends births and gives massages.

Access to scientific health care facilities and practitioners is often associated with a decline
in knowledge and use of medicinal plants (Osoki, Balick, and Daly 2007, Voeks and Leony
2004). Economic affordability and cultural acceptance also influence access to scientific
medicine (Adams and Hawkins 2007). These three aspects are not always present for every
illness event, which may be one reason why people in Tabi prefer the use of herbal remedies for
common ailments. This preference for medicinal plants, regardless of the physical accessibility
of scientific health care, may help in the dissemination of medicinal plant remedy knowledge.

Language and Education and Herbal Knowledge Transmission

Tabi is a village with a high amount of Yucatec Maya and Spanish bilingualism. Almost
all of the adults (98.3%) speak Maya and a high percentage (90.8%) speak Spanish\(^9\). Although
the vast majority of adults could speak Spanish, 74.1% reported speaking more frequently in
Maya and 78.4% reporting thinking more in Maya. This high amount of bilingualism is unusual
for the state of Yucatan where approximately 70% of people are monolingual Spanish speakers

\(^8\) The people in Tabi refer to him as Dr. Nacho, although he is not an M.D. or a D.O.

\(^9\) These percentages are based on interviews I did with one adult in each household in Tabi. It is almost 10% less
than was reported in the INEGI census in 2005. I know there are several people in the community who cannot speak
Spanish from living and interacting with them. Thus the INEGI statistics are somewhat inaccurate and are only used
in this dissertation to understand general trends.
(INEGI 2005). The use of Spanish as a primary language is becoming more prevalent in children; over half of the adults reported (61.2%) speaking Spanish more frequently with their children. There is no notable difference in language ability or use between men and women. Even though Yucatec Maya is the preferred oral language in Tabi, there are only a few people who know how to read or write it. Almost all of the individuals literate in Yucatec Maya are active members of the Jehovah’s Witness religion, which promotes the use of indigenous languages in their faith. I found that with very little training, however, speakers of Yucatec Maya could become literate in the language, as was the case with my research assistants.

Slightly less than 70% (69.8%) of the adults are at least semi-literate in Spanish. In the majority of cases, this is the result of school attendance. Over two-thirds of adults (72.4%) finished second grade or higher. One-fifth of adults finished primary school, 3.4% finished middle school, and none finished high school. In general, fewer adults from Tabi attended school and a greater number are illiterate, and those who attended completed fewer grades, than the statewide averages (INEGI 2005). School attendance is on the rise, yet many children still drop out after they complete primary school. Most adults cannot see the value of an education beyond learning to read, write, and do basic math. Many parents discourage their children from enrolling in middle school because they complain that children only go there to fool around and fall in love. Some young people leave the village to work after finishing primary school and others decide to start families. It is not uncommon for girls as young as 13 to become pregnant and get married. The girls who work in Merida often wait until 18 to marry and start families. There are only a handful of women in their 20s who are not married.

TEK is encoded in languages and is shared with others through language. There is an inextricable link between linguistic, biological, and cultural diversity and the socioeconomic and
political processes that lead to loss of one often lead to a decline in them all (Maffi 2005). Although some local knowledge is retained even after language loss, the richness of TEK does not remain (Posey 2001). Bilingualism may increase TEK through access to information encoded in other languages. Nevertheless, if it ultimately leads to replacement of one language for another, then loss of knowledge encoded in the replaced language will be great. Formal education is also frequently reported as being associated with the diminishment of medicinal plant remedy knowledge. The time spent in school is believed to reduce exposure to informal learning opportunities needed to learn local knowledge (Quinlan and Quinlan 2007, Voeks and Leony 2004). Additionally, formal education may provide individuals with access to jobs in the cash economy (Ohmagari and Berkes 1997, Voeks and Leony 2004). More reliable cash can lead to greater use of scientific health care and reductions in herbal remedy knowledge transmission. In situations where formal education does not improve standard of living, such as is usually the case in Tabi, individuals are likely to continue to learn and share herbal remedies (Gaskins 2003, Quinlan and Quinlan 2007).

**Religion and Politics: Barriers to the Flow of Herbal Knowledge**

Catholicism in the Yucatan dates back to the conquest and, until recently, was the dominant religion throughout Latin America (Carmack, Gasco, and Gossen 1996). The Catholicism practiced in Tabi is a syncretism between ancient Maya religious beliefs and practices and Roman Catholicism. Most people in Tabi are Catholic (45.7%), however, lack of a full-time priest and the denigrating way the part-time priest preaches to the community has led to less active membership in recent years.

In addition, Tabi has witnessed a recent influx of proselytizing Protestants from foreign countries, which has led to mass conversion, changes in spiritual beliefs, and prohibition of the practice of many Maya traditions, especially in the case of the Jehovah’s Witnesses (Stoll 1991).
There are eight Protestant religions in Tabi: Jehovah’s Witness, Baptist, Prophecy of Christ, Evangelical, Pentecostal, Presbyterian, Cavalry Chapel, and Church of Christ. Jehovah’s Witnesses make up the largest percentage of the Protestants (14.7%). They are also the fastest-growing of all the religious groups in Tabi, likely a result of very active proselytizing and an improvement in their standard of living as a result of rules forbidding the consumption of alcohol and an emphasis on the importance of education. Other Protestant groups have been less successful in converting community members; 6% are Pentecostal, 3.4% are Baptists, and 2.6% are members of the Prophecy of Christ and Evangelical churches. The rest of the Protestant religions only capture 0.9% of the population each. In addition, 20.7% of the population is atheist or agnostic.

After spending a few weeks in Tabi it became very apparent to me that religion was one of the prominent distinctions between people in this tiny village. When I visited with Catholics they often asked me how I was received by Jehovah’s Witnesses. They frequently commented that the Jehovah’s Witnesses were clannish and treated people from other religions standoffishly. The Jehovah’s Witnesses’ explanation for the social barrier that they place between themselves and people of other religions was that they did not want to be influenced by the immoral behaviors of others. Thus increase in religious diversity has led to an increase in religious conflict within the community.

Although Jehovah’s Witnesses do not participate in politics, community members from other faiths are fairly active. Their participation is partially because of the relatively large amount of government assistance is doled out based on political affiliation. There are many political parties; but, the three most common are the PRI, the National Action Party (PAN), and the Party of the Democratic Revolution (PRD). Every three years in May there is an election for
the municipal president in Sotuta. An election occurred in 2007 while I was carrying out this research project. Although the PRI candidate received the most votes in Tabi, other communities in the municipality voted more heavily for the PAN candidate who ended up winning. After the municipal president was elected, the villagers held an assembly in August and selected a PRI village commissioner. The commissioner then appointed people for the positions of secretary, security guard, and water treatment manager, electrician, park caretaker, and precinct caretaker. By October 2007 members of the PRI party began protesting for the removal of the municipal president. I heard complaints that his government was only providing aid to PAN supporters in Tabi and not to the entire village. Some of PRI’s protesting tactics included robbing and vandalizing the municipal building, vandalizing the municipal ambulance, and holding sit-ins in front of the municipal president’s office. Around the same time, PAN supporters went to Merida to protest that the governor, who was from the PRI party, was not providing aid to municipalities who elected PAN leadership. These events show that conflict and division occur regarding political parties, and government assistance is an important reason for political participation in Tabi.

In addition to the commissioner of the village, there is also a commissioner of the *ejido*. The approximately 130 *ejiditarios* in Tabi hold an assembly every three years when they vote for the *ejidal* commissioner. He is in charge of everything related to the politics of the *ejido* land surrounding the village. His duties include approving new land uses for different areas of the *ejido* and resolving complaints. The commissioner appoints a secretary and a counsel of vigilance to assist him. The *ejido* political positions are all voluntary, whereas the village commissioner and the people he appoints are all paid a minimal salary by the municipal government.
Religion and politics both have the ability to inhibit the transmission of herbal remedies by creating communication barriers. Conflict between different religions and political parties can result in a reduction in transmission of knowledge between different groups. The distribution of medicinal plant remedy knowledge may also be limited by clergy’s discouragement of its use (Caniago and Siebert 1998, Voeks and Leony 2004). An example of this in Tabi is that Jehovah’s Witnesses are taught that evil eye, an illness commonly believed to exist throughout Catholic Latin America, is a superstitious and supernatural illness that does not actually exist.

**Conclusion**

This chapter provided the context within which this study was carried out. It also outlined some of the major biological and social constraints to the flow of herbal knowledge along with opportunities that increase motivation to learn about medicinal plants. Biological and physical characteristics of the environment—including poor and rocky soil, warm and humid climate, and two distinct seasons characterized by quantity of rainfall—limit the type of plants that can grow in Tabi. Major human modification of the low deciduous forest in Tabi’s *ejido*, through extensive slash-and-burn and intensive agriculture, charcoal production, cattle grazing, and introduction of non-native plant species, further influence the plants that are available for use as medicines.

The Maya living in Tabi have had a long time to develop herbal remedies with the plants available to them because of their long history in that location. There are many factors, however, that may influence the sharing of that knowledge. The modern diet in Tabi, which lacks vegetables, greens, and dairy, and is abundant in carbohydrates, fat, and junk food, is causing many health problems that could either help promote the dissemination of medicinal plant remedy knowledge or encourage people to use scientific medicine for their health issues. Augmented physical access to pharmaceuticals and scientific medicine health care practitioners could result in a reduced need for the sharing of herbal remedies. Increased bilingualism and
formal schooling could have the same effect. Religious and political affiliations could cause social barriers that may inhibit the flow of medicinal plant remedy knowledge.

A theme that runs through the pre-Columbian, historical, and ethnographic descriptions of the Yucatec Maya is their extremely dynamic and adaptive nature as a cultural group. The people of Tabi are in no way an exception. The Maya have experienced diverse conditions over time, which has compelled them to change various aspects of their culture. There have been times when they learned from and re-incorporated aspects of their own cultural practices from their past into their current-day survival strategies. On other occasions they incorporated aspects of external cultures either by force or through their own choice. Instead of replacing past cultural practices, however, the Yucatec Maya often adapt these external practices in their own way to accommodate their needs. This ability to adapt has led to the continued survival of this cultural group for many millennia.

This adaptability is extremely important to the survival of cultural knowledge, such as herbal remedies, especially during a time of heavy outside influence through globalization and modernization. This was one of the main reasons why I decided to work with the Yucatec Maya on this project. In addition, their long history of occupation of the region and extensive development and use of herbal remedies attracted me. Lastly, I felt compelled to honor the intense connection I felt to the Yucatan Peninsula and its people in the selection of my research site.
Figure 2-1. Map of Tabi’s location in the Yucatan Peninsula of Mexico
Figure 2-2. The Catholic church, located in the center of Tabi, was built in 1700. Religious diversity has increased dramatically in Tabi over the last 20 years and is a source of conflict in the community.

Figure 2-3. The health care clinic in Tabi was established in the 1980s and is run by the Servicios de Salud de Yucatán. The clinic provides community members with access to scientific medicine.
Figure 2-4. All plants in this region including cultivated plants, like the squash growing in this farm field, and medicinal plants grow in thin and rocky soils.

Figure 2-5. The sinkhole is an important landmark in the center of Tabi and was a source for water before running water was installed in the 1980s.
Figure 2-6. Leaves and ephemeral herbs, important ingredients for herbal remedies, return to the landscape during the early wet season.

Figure 2-7. During the dry season it is difficult to find some medicinal plants because the leaves fall off trees and many of the herbs disappear.
Figure 2-8. Yards and home gardens are the most common place to gather the ingredients for common herbal remedies in Tabi.

Figure 2-9. Medicinal plants that are not available in yards and home gardens are often found along trails to farm fields.
Figure 2-10. Traditional housing compounds are the location of many herbal remedy learning opportunities.

Figure 2-11. Most housing compounds now include a block house constructed with the materials from FONDEN.
Figure 2-12. The women’s domain in Tabi is the home and the yard. One typical task for women is to prepare food.

Figure 2-13. The domain of men in Tabi is the farm field and the forest. One common task for men is to tend to their bee hives located in the forest.
Figure 2-14. Mexican hairless pigs are the favorite animal to consume in Tabi because of their high fat content and rich flavor.
CHAPTER 3
METHODS

This chapter details the various processes that went into carrying out this research project. There were three objectives in this study. The first was to gain an understanding of the ethnomedical conditions present in the community and to discover which plants were used to treat them. The second was to establish the distribution of medicinal plant remedy knowledge in the community. The third objective was to study the influence of attribute and relational variables on the distribution of medicinal plant remedy knowledge.

There are three types of medicinal plant remedy knowledge: remedies that are common knowledge for almost all families, remedies that are known by family members especially interested in traditional medicine\(^1\), and remedies that are known only by specialists\(^2\) (Anderson 2005b). In this study I focused on the first two types of knowledge. The treatment of illnesses most commonly starts in the home by non-specialists. Only if non-specialists are unsuccessful do they seek assistance from a specialist in the folk or professional sector. The prevalence of treating illnesses in the home warrants a need to learn about the remedies being used and the transmission practices. Most medical ethnobotanical research, however, focuses on specialist knowledge (one notable exception is Berlin and Berlin 1996). The result is a bias in the scientific literature toward the personalistic (or supernatural) perspective (Berlin and Berlin 1994). This study is intended to help correct this bias by researching generalized knowledge.

Site Selection

In the summer of 2006 I acquired 2005 census data from INEGI for all the towns in the state of Yucatan. I used those data to narrow down the potential research sites. My selection

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1 Older individuals in the village

2 Herbalists, h-meen (spiritual healers), and midwives
criteria were a small population size, a high percentage of bilingual Maya and Spanish speakers, and a high percentage of the population working in the agricultural sector. A small population size was required because I wanted to interview all the adults in the community, which is common practice in whole network studies (Wasserman and Faust 1994). However, I did not want the population to be so small that there would be little variation in common medicinal plant remedy knowledge within the group. Therefore I selected communities with 200 to 1,500 people. A positive correlation exists between linguistic, cultural, and biological diversity (Maffi 2005), so I selected communities with high levels of bilingual Yucatec Maya and Spanish speakers to foster communication³ and to maximize variation in TEK without too much overall loss⁴ (Maffi 2005, Posey 2001, Zent 2001). Lastly, I selected communities with a high percentage of people working in agriculture because people who work directly with plants for their livelihood often have more knowledge about them (Garro 1986, Gaskins 1999). The results of this selection process were seven communities with 230 to 1,315 people with 40%–82% bilingual, and 57%–88% working in agriculture.

For two weeks in February 2007 I traveled to the seven communities chosen using the preliminary selection process. My goal was to find a community where people still used medicinal plants and that was open to having a foreign woman live and do research there. I met with the commissioner of each community, explained my project, and indicated that I was looking for a community where I could carry it out. The commissionners asked questions about my project and I asked some open-ended questions about the community’s use of medicinal plants and their willingness to have me there. In five of the seven communities the

³ I took a six-week intensive Yucatec Maya language course in the summer of 2006; I learned a lot of Yucatec Maya but not enough to be comfortable having conversations in it. I am fluent in Spanish.

⁴ I would expect more loss of TEK to be present in communities where people only speak Spanish.
commissioners told me that the community members tended to go to the scientific medical
doctor and use pharmaceuticals rather than medicinal plants to treat their illnesses. Only one
commissioner was not willing to let me do my research in his community. In the two
communities that still use medicinal plants I asked the commissioners about logistical factors
such as transportation between villages, potential housing, and cell phone access.

After speaking with the commissioners and getting approval to potentially do research in
their communities, I met with scientific health care providers, if there were any in the
community, and local citizens. The health care providers were especially helpful because they
were often not from the community and could provide me with their personal experience
regarding how the community responded to them as outsiders. They also had a good idea of the
importance of scientific medicine as compared with traditional herbal medicine in the
community. Speaking with members of the community gave me direct experience as to how they
would treat me if I did my research there. They were also a great resource for logistical
information. Of the two communities where medicinal plants were still generally valued and
used I decided on Tabi because it had a smaller population, higher bilingualism, greater
percentage of people working in agriculture, and less overall modernization influence. For
example, compared to the average for the rest of the state of Yucatan, Tabi has higher fecundity,
lower literacy, a higher percentage of people who had never attended school, a lower number of
grades completed in school, and more bilingualism⁵ (INEGI 2005).

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⁵ Monolingual Spanish speakers are the majority in the state of Yucatan.
Community Support

The first week I was in Tabi I met with the rest of the people who held political positions including the secretary, the village commissioner, the ejido commissioner, and his secretary\textsuperscript{6}. I explained to each of them what I was doing in Tabi and got their permission to proceed. Then I held a community meeting. I posted a flyer on the town hall wall and invited the whole community to come and learn about my research project. The attendance at the meeting was low with only about 20 women and a few men in attendance. After I finished explaining what I was doing in Tabi I asked if there were any questions. I fielded the questions and the general consensus was that I was welcome to move forward with my project. A few women came up to me after the meeting and offered to let me interview them first; I took them up on their offers. The next couple of weeks after the meeting I spent a lot of time in the health care clinic, which allowed me to meet a large number of people in a short period of time and explain to them about my research project. Many of them already knew something about it even though they did not attend the meeting; news travels fast in Tabi.

The Research Team

In July 2007 I received a dissertation improvement grant from the National Science Foundation (Award No. BCS-0719053). A portion of the money was designated for two research assistants. I decided to hire my research assistants from Tabi for several reasons. I was more familiar with the young people in Tabi than I was with anyone from the nearby villages, which made it easier to select research assistants. Also, if I hired from within Tabi, I would not have to find or pay for housing or transportation for the assistants. In addition, I wanted to give an

\textsuperscript{6} The \textit{ejido} is communally held land surrounding the community where the men farm.
opportunity to a few people to learn about scientific research and to earn some money in a place where there are no other opportunities of this type.

The criteria I used for selecting research assistants were that they had finished ninth grade, were fluent in Maya and Spanish, had experience using a computer, had a positive attitude, and had a willingness to learn. I selected people who finished ninth grade because they would tend to have better grammar and problem-solving skills and an appreciation and patience for learning through research than someone who had not finished middle school. Fluency in Maya and Spanish was especially important because I needed help writing and editing interview questions, translating the questions to Maya, and administering the questionnaires in Maya and Spanish. I wanted someone with some experience with a computer so I would not have to spend much time training them in basic computer skills. The positive attitude and willingness to learn were important because so many of the activities I would ask them to do were so different from anything they had ever done before.

I started my search for research assistants by asking key informants if there was anyone they knew who might be interested in working with me. In addition, I asked the principal of the middle school if there were any alumni she would recommend as potential research assistants. The list consisted of five unmarried females. I visited each of the potential research assistants and spoke with them and their families about the position. There was one family who refused to let their daughter work with me. I interviewed the remaining four girls regarding their skills. I hired Guadalupe Chan Poot because she had all the skills I was looking for plus a high school degree and an interest in continuing her schooling, and I hired Layda Chan Ku because she was fluent in Maya. The other two girls were not fluent in Maya.

7 All the young men willing to do this type of work were either working or going to school, which made them ineligible.
Both girls began working for me in the middle of July 2007. I trained them throughout our time working together depending on the task that needed to be done. Guadalupe taught herself to read and write Maya when we first started working together\(^8\). We worked together to teach Layda to read Maya, but she was never able to write it. I taught them how to structure good interview questions and they taught me how to write questions in locally understandable ways. Once we completed the structured interviews we practiced them for hours using role play. Then we pretested the questionnaires, made some changes, and practiced them some more. I also taught them why it is important to collect herbarium specimens and how to do it. I showed them how to preserve them if they could not be dried immediately. I taught them how to carry out open-ended interviews. They learned how to probe for more information in a tactful way and record it so that it would be meaningful for someone else who was reading their notes. Guadalupe frequently entered data while Layda read the information to her\(^9\).

**Sampling Frame**

When I first arrived in Tabi I spent a lot of time with the medical resident, Fabiola, and the nurse, Rosy, in the state-run health care clinic. They had been working in Tabi eight months and knew the community quite well and had good reputations. The first week of research in Tabi Rosy gave me a map of the community that a previous medical resident had created so he could keep track of patients’ records and record the spread of illnesses, such as dengue, throughout the community. The map broke the village down into sectors, blocks, households, and families; each nuclear family had a number based on the sector, block, and household where they resided and the family they belonged to within the household. I adopted his system of identification for my

\(^8\) There is no standardized orthography in Yucatec Maya and the majority of people who speak Yucatec Maya cannot write or read it.

\(^9\) Layda did not have a desire to learn how to use the computer; if she had I would have taught her how to use it.
study. I updated the map by walking the village, speaking to home owners, and recording changes that had occurred. This was a great way to explore the community, learn about the structure of the households, and get to know people and tell them a little more about my project before actually starting interviews.

Fabiola gave me access to all the demographic records she had on the families in Tabi. The records included the complete name for every person in the family, their sex, date of birth, relationship to the heads of household, year completed in school, whether they had health insurance, and whether they were enrolled in Oportunidades (Opportunities). During my first month working in Tabi I entered the records into an Excel spreadsheet and gave Fabiola a copy as a thank-you for her help. The major benefit of obtaining these records was that I no longer had to gather data on who lived in each household to create a sampling frame. Instead I was able to use the information to create the list of available people to interview in the structured interviews. I also used these records as references to help confirm what people told me in their interviews.

**Informed Consent and Compensation**

I submitted my protocol and informed consent forms to the University of Florida Institutional Review Board (IRB) office and obtained approval on April 3, 2007 (IRB protocol number 2007-U-0259). Before my research assistants or I interviewed each participant, we described the project and what their involvement would be in it if they decided to participate. We also explained that there were no known potential risks to participating in the project. Then we

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10 Opportunities is a program in which the government gives poor families money. To qualify for the program the family has to meet one of the following criteria: have a pregnant woman, undernourished child below the age of four, and/or a child in school between third grade and high school. The money is used to improve the quality of food consumed in the household. It is also used to offset the amount of money a child could make if he dropped out of school and went to work. In exchange for the money the women heads of households must attend preventative health care seminars and clean the community health care clinic.
received verbal consents from the participants before interviewing them\textsuperscript{11}. Only three of the people we approached decided not to participate in the project.

When I first arrived in Tabi I was very impressed by the willingness of so many people to participate in my study without any discussion of compensation. I had always intended to compensate the community, but was not sure how so I did not make known my plans. I did not think monetary compensation was appropriate in a subsistence farming community with such a strong sense of volunteerism. I also was concerned that if I gave money it would go toward alcohol and not toward things that would benefit the family\textsuperscript{12}. Then I mulled over the idea of compensating the participants with one large gift to the entire community. I soon learned that there have been many problems with communal ownership of things. Ultimately, I decided to give each family a bag of non-perishable food items and an illustrated medicinal plant remedy recipe book based on common recipes people in Tabi described to me (Appendix B). I gave them food items because I knew it was something everyone in the family would benefit from and enjoy. The book consisted of recipes for common medicinal plant remedies in Tabi. I gave the book to them as a documentation of a small portion of the rich medicinal plant tradition in the village; my hope was that it might stimulate interest in medicinal plants among young people and could be used as a teaching tool for them.

\section*{Defining the Domain}

Defining the domain and what will be included in the domain is important for comparative purposes. In this study the knowledge domain of interest was herbal remedies. For the free-listing activity, remedies were only grouped together when they had exactly the same plants used.

\textsuperscript{11} There are many people in Tabi who are illiterate, making written consent impractical.

\textsuperscript{12} Alcoholism is very prevalent among men in Tabi.
to treat the same illness. This is an extremely strict definition of a remedy and was employed here because I was interested in the most widely shared remedies in the community. Most studies on medicinal plant knowledge variation focus on the plants that compose remedies and not on the remedies themselves (cf. Reyes-Garcia et al. 2007 for a review). Greater attention should be paid to identify the plants that are commonly included together in a remedy. The outcome would be data sets with richer and more accurate depictions of medicinal plant remedy knowledge in communities. These data sets could be used by researchers to understand how plants are used in combination to cure illnesses. Based on the data from this study, this type of analysis is important because, although most common remedies consisted of one plant, the majority of remedies free-listed were composed of more than one plant. Medicinal plant remedies are like cooking recipes; there are certain ingredients that are crucial and there are other ingredients that are added based on the personal preference of the preparer. One of our challenges as ethnobotanists is to figure out the critical ingredients because those are the ingredients that make up the essence of the recipe and are the most likely to be efficacious. The only way to do that is through documenting all the ingredients in the herbal remedies.

**Unstructured Data Collection to Inform Structured Surveys**

The data collection process was divided into two stages, unstructured and structured. The unstructured data collection not only helped create culturally appropriate questionnaires, but also provided a rich context within which to place the results of the questionnaires. They provided information on the ethnomedical conditions in Tabi, the various herbal treatments for those remedies, and how they prepared the remedies. In addition, they supplied information on the day-to-day context within which people utilized these various treatments. The results from the structured data collection were used to test the hypotheses. Data from a questionnaire on medicinal plant remedies were used to describe the distribution of knowledge in the community.
Results from the demographic household survey were used to show the influence of different attribute variables on the distribution of knowledge. The whole network and personal network data were used to understand the affect of relational variables on the distribution of knowledge. A time line of the research is in Appendix A.

**Participant Observation of Life in Tabi**

Participant observation is a method that is quintessential to cultural anthropologists. The method involves living with a cultural group for an extended period of time, learning their language, and participating in their daily activities while observing what is going on and recording it (Bernard 2002). The idea is that the researcher’s constant presence in the village ultimately makes them less conspicuous and allows them to see things that a stranger would not be privileged to see. Another important component of participant observation is gaining the trust of the community members with the intent that you will be able to ask questions and give information that would have originally been off-limits (Bernard 2002).

When I first started my research I could not find any place to live in Tabi, so I lived with Rosy’s family in Sotuta, a town 11 kilometers away, and I commuted with Fabiola and Rosy daily. However, I found their schedule was a big constraint on my time in the community and I was losing out on a lot of valuable participant observation opportunities. In addition, I felt like the community members were not opening up to me as much as they would if I lived with them. At the end of April 2007 I went to a house to interview Maximiliano and Eloisa. We got along very well and at the end of the interview they offered to let me stay in a house one of their daughters who works in Merida had built. The house was right across the lane from the couple’s

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13 Rosy was the nurse in the clinic.

14 Fabiola was the medical resident in the clinic.
home. I decided to take them up on their offer and I moved to Tabi a few weeks later. I lived in that house, shared meals with the family, and spent a good part of my free time interacting with them for the rest of my time in the village. Living with the Cetz Canche family really helped me to gain rapport with the community. People seemed to respect me more because they saw firsthand that I slept in a hammock, ate their food, and helped out with daily activities. I was also able to learn a lot about daily life in the village by living with them.

Some other ways I was able to gain rapport was by participating in the preparations for holidays and special occasions. I would help prepare meals, set up the space where the event was to take place, and run errands. I quickly became the village photographer for all major events because I was one of the few people with a camera, and I gave the pictures away for free as thanks for the community’s participation in my project. These were great opportunities to get to know the community members better and helped me learn about the customs and traditions in Tabi. I also participated in activities related to medicinal plants. I went medicinal plant collecting with a healer, participated in a medicinal plant course a healer taught in another village, witnessed the use of herbal remedies in homes, and got treated with medicinal plants for illnesses I suffered. After several months in the village I found that people really opened up to me and started offering information about taboo subjects such as suicide, incest, and adultery. I also noticed that they were more willing to answer the difficult questions I posed.

**Free-listing of Medicinal Plant Remedies**

Free-listing is one of many techniques in the family of cultural domain analysis. The goal of cultural domain analysis is to understand how people in a culture think about and group physical and conceptual things (Bernard 2002). These groups of physical and conceptual items within one culture are defined as cultural domains. Free-listing is a simple technique where participants are asked to identify items within one cultural domain. Some examples of possible
domains are types of firewood, fruits, or trees used for building materials. Free-listing can provide information on which items were stated first and most frequently by the individuals. This information can help investigators understand the basic cognitive structure of the domain (Borgatti 1996). This technique, however, is most often used to identify a list of culturally salient items that can be used in other data collection techniques such as consensus analysis\(^{15}\) (Borgatti 1996), which is how I used it in my study. In most free-lists there are some items shared by many individuals and many more items only mentioned by one person. Thus this technique not only allows us to identify the shared knowledge but also the variation in knowledge among a group of people (Quinlan 2005). This method has been used in a number of medicinal plant studies (e.g., Canales et al. 2005, Finerman and Sackett 2003, Ladio, Lozada, and Weigandt 2007, Nolan and Robbins 1999, Quinlan 2005, Trotter II 1981).

Before interviewing people in Tabi, I pretested the free-list questions on some women from Zavala, a nearby village. First I asked them to list all the medicinal plants they knew. Then I used non-specific prompting and reading back the plants listed to elicit a more complete list of responses (Brewer 2002). Next I asked them to list all the illnesses treated by each plant. I used the same prompting techniques that I had used for the plant names. I found that instead of telling me all of the plant names and then the names of the illnesses that the plants treated, the participants preferred to tell me the plant and the illness it treated at one time. I also found that the participants were very patient and tried their hardest to recall all the remedies they actually knew. They were not patient with me, however, when I tried to read back the list of remedies to elicit more responses. Their lack of patience was understandable considering many of the

\(^{15}\) Consensus analysis is used to quantify the amount of knowledge people have within a domain (Bernard 2002). Bernard, H. R. 2002. Research methods in anthropology: qualitative and quantitative approaches, 3rd edition. Walnut Creek, CA: AltaMira Press.
remedies consisted of multiple plants\textsuperscript{16} and some people listed large numbers of remedies\textsuperscript{17}, thus reading them back became a time burden and did not elicit many new responses.

In Tabi I interviewed people from 40 different households using the free-listing technique. It is recommended that free-listing be done with approximately 30 individuals (Borgatti 1996). I changed the questions and the way I administered the free-list based on what I observed in the pretest interviews. First I asked the participants to list all the medicinal plant remedies they knew. After they finished listing all the remedies, I prompted them by asking them to list any other medicinal plant remedies they knew\textsuperscript{18} and I also read back the list of illnesses and asked if there were any other plants they knew to treat those illnesses. In cases where the husband and the wife were both present, it was difficult to get only the interviewee to respond. In cases where the spouse responded first it was clear whether the interviewee knew the remedy or not. Only those remedies known by the interviewee were recorded.

Open-Ended Interviews on Illnesses and Medicinal Plant Remedies

My research assistants did open-ended interviews about 33 illnesses based on the remedies that had a frequency of at least three on the free-list. The goal of these interviews was to get a better understanding of the ethnomedical conditions that were known to be treated with medicinal plants in Tabi. The illnesses included in the interview were gastrointestinal ailments, skin problems, reproductive issues, aches and pains, fever, asthma, diabetes, snake bite, and evil eye. They asked five open-ended questions about each illness. The questions asked were about the perceived causes, the symptoms, preventative techniques, treatments, and the severity of the illness. Only five interviews were conducted because there was minimal variation in what the

\textsuperscript{16} Some remedies had as many as eight plants.

\textsuperscript{17} One participant free-listed 89 different remedies.

\textsuperscript{18} This is considered a non-specific prompt.
informants reported, so there was no need to interview a large number of individuals (Bernard 2002). In addition, the interviews were a huge time burden and I did not want the participants to tire of answering questions when I still had many other interviews I wanted to do with them. It was difficult to get men to participate in this interview because of its length and the relatively short amount of time they spend at home compared with women. Therefore most of the informants were woman of varying ages. There was one middle-aged male participant and his responses did not vary much from the women.

My research assistants also interviewed seven people about their recipes for medicinal plant remedies. I selected seven individuals, six women and one man, for them to interview who were knowledgeable about medicinal plants and who were willing to spend a long time explaining the different remedies. The remedies reported by at least three individuals in the free-list were included. The survey instrument consisted of questions about the type and amount of ingredients used, the instructions for preparing the remedy, and how it should be administered. This information served a dual purpose. It was used to create a recipe book of herbal remedies, which I gave to each participant as a gift, and it helped me gain a better understanding of how people in Tabi use plants for medicine.

**Medical Ethnobotanical Specimen Collection**

On April 25, 2007, I met with Germán Carnevali Fernández-Concha, the director of the herbarium at the Centro de Investigación Científica de Yucatán (CICY), and he granted me permission to collect plants under the herbarium’s plant collection permit (FLOR-0025) from Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). In July 2007 and again in November 2007 my research assistants and I gathered samples of the medicinal plants reported by at least three individuals in the free-listing interviews. We always collected plants with someone from the community who was knowledgeable about medicinal plants. First I took
pictures of the entire plant, the leaves, fruits and flowers if available, and bark if it was a tree species. Then I collected five samples for each medicinal plant. I tried to collect fertile specimens whenever possible, but in some cases I was only able to collect vegetative samples. My assistants wrote the common name of the plant and the collection number on newsprint. Then they arranged the plant sample inside half a sheet of newsprint and pressed the plants in a field press.

In the evening of the same day we collected, I removed the plants from the plant press and wrapped the entire group tightly in newspaper and taped the edges with duct tape. The first two times we collected I was not able to get to the herbarium for a week so I preserved the plants with an ethanol solution. Plant specimens will only last a day or two in the heat and humidity without being dried. On those occasions I placed the bundle of specimens in a large plastic bag and poured a solution of 40% ethanol over the plants (Carnevali Fernández-Concha 2007). I poured in just enough solution to dampen the newspaper but not enough to leave it standing in the bag. Then I closed the bag tightly by twisting the top and binding it with a rubber band. I monitored the newspapers daily and if they started to dry out I would add more ethanol. On subsequent occasions I always collected the plants only a day or two before I was able to get to the herbarium; thus the ethanol treatment was not necessary.

All the plant specimens were taken to the herbarium at CICY where they were dried in an oven specifically designed to accommodate plant presses. The drying usually took two to three days to complete, depending on the thickness of the plant parts. Then José Luis Tapia Muñoz, a technician at the herbarium and an expert on flora of the Yucatan, identified all the plants to genus and species (cf. Table 3-1 for a list of the plant species collected, the date collected, and the initials of the collectors). The species were grouped into families based on the Angiosperm
Phylogeny Group’s most recent classification for flowering plant families (APG 2003). A duplicate of each plant specimen was deposited in the herbaria at CICY, the University of Florida, the University of Georgia, and the Missouri Botanical Garden and also in the Ethnobiology Laboratory at the University of Florida.

**Structured Data Collection to Test Hypotheses**

A demographic household survey, a medicinal plant exam, a whole network questionnaire, and a personal network questionnaire were carried out with study participants. After spending some time in Tabi I realized that many health care decisions were made jointly by the adults in the household. Casagrande (2002) had similar findings with the Tzeltal Maya in the highlands of Chiapas; the Tzeltal Maya acquired information about medicinal plants from family, friends, neighbors, and health care specialists, which was shared within the household. Based on that finding I decided to focus on information sharing between households by administering the structured interviews to one adult in each household. I define household as the members of a family that live together on the same yard. Twenty-five of the 122 households had more than one nuclear family\(^{19}\) living in the household.

In the case where there was one expert\(^{20}\) in the household, I selected that person to be interviewed\(^{21}\). In some cases there was more than one household expert and in other cases there was no household expert; I decided to randomly select the person to be interviewed in either case. If there was no household expert and there was more than one family living in the household, I chose between the two eldest members of the household. There were 122 people selected to participate in the study, but, three chose not to participate.

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\(^{19}\) A nuclear family is a mother, father, and their children.

\(^{20}\) An individual who is more knowledgeable about medicinal plants than the rest of the members of the household.

\(^{21}\) The experts were determined by the people within each household.
I wrote all the questionnaires in Spanish based on ethnographic data I collected in the first several months I was in Tabi. Alfonso, a researcher in the Department of Management and Conservation of Tropical Natural Resources at the Autonomous University of Yucatan (UADY), proofread and translated the questionnaires into Maya. Then, my research assistant, Guadalupe, translated the questionnaires back into Spanish. If there were any discrepancies between the original questions in Spanish and Guadalupe’s translations, then she and I worked together to correct the questions in Maya. Then we pretested the questionnaires with 30 individuals in Tabi. The pretest allowed us to identify and address any lingering problems with the wording of the instructions and questions, the order of the questions, and the response options before we started the actual interviews. It also gave my research assistants and I an opportunity to practice interviewing.

One part of the whole network questionnaire consisted of a list of the full names of the participants. During ethnographic data collection I learned that it was problematic to refer to people by their birth name because most people were not familiar with them. Nicknames were a much more common form of addressing individuals within the community. I resolved this issue by sitting down with a few key informants and asking them the nicknames of all the people I planned on interviewing. On the few occasions that the key informants were not sure of an individual’s nickname, I went to the houses of those individuals and asked them their nickname. I read the nicknames to other individuals in the community to confirm that they were all correct. Once I started referring to people using their nicknames, the confusion diminished.

**Cultural Consensus Analysis to Measure Medicinal Plant Knowledge Variation**

Cultural consensus analysis (CCA) was used to determine if all the responses to the interview belonged in the same domain and how much knowledge an individual had within that domain. I used the individual competence scores calculated by CCA as a proxy for determining
the distribution of medicinal plant remedy knowledge within the community. CCA was developed from the idea that not everyone is equally competent in their own culture (Romney, Weller, and Batchelder 1986). There are two types of knowledge, individual and social knowledge (Carley 1986). Knowledge transitions from individual to social by sharing it with more than one person. The more people share the knowledge, the more social it becomes. Thus consensus is a way of determining the amount of sharing of knowledge within a domain among a group.

CCA, created by Romney, Weller, and Batchelder (1986), is a technique that provides the conditions under which more agreement between individual responses to a set of questions can be interpreted as greater knowledge (Borgatti 1996). It also creates a culturally correct answer key based on the shared responses of a set of informants within one cultural domain (Romney, Weller, and Batchelder 1986). Then it tests the cultural competence of each informant within that same cultural domain by comparing their responses to the newly created answer key. Those individuals who are most culturally competent are those who most frequently share the modal response among all the informants (Romney, Weller, and Batchelder 1986).

The three assumptions that must be followed for the model to work are that 1) informants must share a common culture\(^{22}\), meaning any variation between informants is a result of individual differences in knowledge and not the result of being members of a subculture, 2) informants must answer the test questions independently of one another, and 3) all test questions must come from the same cultural domain. Even if the assumptions are somewhat violated, the results achieved can be relied upon because the model is very robust (Romney, Weller, and Batchelder 1986).

\(^{22}\) Romney and colleagues are referring to culture as information that is stored in peoples’ minds and is shared and learned between individuals. See Robert’s (1964:438-439) description of culture as “information economy” and D’Andrade’s (1981:180) explanation of culture as an “information pool” for more information about how Romney and colleagues conceptualize culture.
Batchelder 1986). The analysis calculates the proportion of matches between all pairs of informants and adjusts for guessing (Borgatti 1996). Then a factor analysis is run on these data. If the three assumptions are met, and if there is a single-factor solution (taken as a ratio of at least three to one between the first and second factors), then the first factor is interpreted as knowledge and the individual factor scores are equivalent to knowledge scores (Romney, Weller, and Batchelder 1986).

A few studies have used systematic techniques to study intra-cultural knowledge variation of medicinal plants. Techniques used to measure knowledge are typically frequency of medicinal plants reported (Geissler et al. 2002, Prince et al. 2001, Vandebroek et al. 2004), matching between informants (Johns, Kokwaro, and Kimanani 1990, Johns et al. 1994), matching with cultural experts (Caniago and Siebert 1998, Sternberg et al. 2001), and matching with scientific data (Ghimire, McKey, and Aumeeruddy-Thomas 2004). Although CCA is the most sophisticated tool available to measure intra-cultural variation, it has rarely been utilized to study individual variation within the domain of medicinal plants (cf. Reyes-Garcia et al. 2008b for exception). It has, however, been used in a wide variety of studies on intra-cultural knowledge variation (cf. Romney 1999 for a review) including various studies in non-medicinal plant ethnobotanical domains (Atran et al. 2002, Casagrande 2004, Reyes-Garcia et al. 2005, Rocha 2005, Ross, Barrientos, and Esquit-Choy 2005).

I chose to use CCM to measure individual medicinal plant remedy knowledge variation in this study because it is a well-established statistical model for measuring the extent that knowledge is shared (Batchelder and Romney 1988, Romney, Weller, and Batchelder 1986). Since CCM is a formal model, its claims can be tested, its assumptions are explicit, and it is validated against modest violations of the assumptions (Romney, Batchelder, and Weller 1987).
Some specific benefits of the method are that it determines if there is enough agreement between respondents to aggregate their responses and it determines how to aggregate the data (Borgatti 1994). While determining whether to aggregate the data, the analysis adjusts for guessing, which means that the amount of agreement between respondents is not overestimated (Romney, Weller, and Batchelder 1986). If there is enough agreement, it provides individual estimates of knowledge compared to the group (Baer et al. 2003). Lastly, it provides an estimate of the culturally correct answers to the set of questions posed to the participants (Romney, Weller, and Batchelder 1986).

Some downsides to this method are that it is not applicable to all data sets because of the assumptions of the model (Romney 1999). It also has explicit rules about the proportion of positive versus negative responses; some researchers may find it difficult to produce questions that elicit responses within the range of positive and negative responses appropriate for the model (Weller 2007). In cases where consensus is not found, the researcher can no longer use the individual competence scores to measure variation, although further analysis can be done on the data to determine if there are subgroups where consensus does exist (Romney 1999). None of these limitations were a problem in this study.

The first task I completed was to select the plant-based remedies to include in the questionnaire. I did that by going back to the data from the free-listing interviews. There are many methods for selecting which free-list items to use in further analyses (e.g., Borgatti 1996). The one I chose was the frequency method. I selected all the remedies with a frequency of three or higher because they represent shared knowledge. Then I removed remedies for burns, hair loss, and dandruff because they were not very commonly reported as being treated by medicinal
plants\textsuperscript{23}. Next I removed the remedies for diabetes because many people expressed that there is no way to cure diabetes, just control it. I also removed the remedies for spasms of the blood and stomach because I was unsure of their scientific medical correlates. I reduced the list even more by keeping only one remedy for each illness except for diarrhea. In the case of diarrhea I kept two because there was such a large number of remedies for diarrhea of different types in the free-list. The final selection was 23 remedies with mention in the free-list by three to 20 people out of the 40 who participated in the exercise\textsuperscript{24}.

The next step was to create questions that would likely be answered in the negative to avoid response bias (Weller 2007). On scraps of paper I wrote 22 of the most frequent illnesses that the people treat with herbal remedies. Then I wrote the names of 22 plants that made the first selection but were cut in the final selection. Next I matched a plant with an illness that was dissimilar to the illness that the people of Tabi used it to treat. I looked up the plant name in *Nomenclatura, Forma de Vida, Uso, Manejo y Distribución de las Especies Vegetales de la Península de Yucatán* (Arellano Rodríguez et al. 2003) and checked to see if it was reported as being used to treat the ailment for which I paired the plant. If it had been reported to treat that illness, then I switched the illness for one that was not reported as being treated by the plant. Then I searched for the plant-illness pair in the original free-list data from Tabi. If I found that they were paired together, I would switch the illnesses until all were pairs that had not been reported in the free-list data.

The final survey instrument was 45 questions in the format “Can _____ cure _____?” and I interchanged the various plants and corresponding illness names in the first and second blanks.

\textsuperscript{23} There was less than four different remedies to treat those ailments in the original free-list data.

\textsuperscript{24} The highest frequency for any remedy listed in the free-list.
respectively to create the questionnaire (Table 3.2 and Table 3.3). The participants had the option of answering affirmatively, negatively, or uncertainly for each of the questions. We also asked if each plant was mixed with any other plants to cure the corresponding illness. The participant had the same response choices as to the first question. If they answered affirmatively, we asked them to name the plants that were mixed with the plant in the question. My research assistants and I administered the questionnaire to the participants in 119 different households. When we asked each question we showed the photo of the plants that corresponded to the question to make sure that everyone answered it about the same plant.

When entering the data, if the participant said they did not know whether the plant cured the illness, then I simulated guessing by flipping a coin. If the coin landed with heads up, then I marked their answer as positive, and if the coin landed with tails up, then I put their answer as negative (Weller 2007). If the person said they mixed the plant with other plants to cure the illness, then I still recorded the original plant as curing the illness.

Three participants who answered affirmatively to all or all but one of the questions, even the remedies I had created. I decided to remove these individuals from the analysis because I felt like their responses were not an accurate depiction of their actual knowledge regarding remedies known in the community. All three individuals are older men who were deemed household experts by their family members. They likely responded the way they did because they believe that all plants cure and they assumed that the plant and illness combinations I had in the questionnaire must be correct even though they personally had not heard of some of them. The philosophy that all plants cure, but that people were not always sure what they cure, was often

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25 Sometimes one plant can have more than one common name, even within the same village, thus the photos helped to avoid confusion regarding the name of the plants.

26 The calculations done in cultural consensus analysis adjust for guessing, which is why guessing had to be simulated in the cases where individuals did not know the answer and would not guess.
shared in casual conversation by older individuals in the community. Thus 116 peoples’
responses were used in the analysis.

**Demographic Household Survey to Measure Attribute Variables**

Previous research on TEK has shown that intra-cultural variation is often the result of
personal attributes. The goal of the demographic household survey was to measure the attribute
variables so I could test their influence on the distribution of medicinal plant remedy knowledge
within the community. I determined that a questionnaire was the best way to obtain the
information because the participants were asked the same sets of questions and responses,
allowing me to compare the results across people (Bernard 2002). My ethnographic data were
used to inform the questions and responses in this questionnaire.

I wrote one question for each single indicator variable: sex, age, occupation, level of
formal education, and religion. In some cases I asked two questions to confirm the responses. For
example, in the case of age sometimes the individuals would know their age and not their date of
birth, and other times they would know their date of birth and not their age. If the two responses
did not match, then we would discuss the discrepancy with the participant until we came to an
agreement. Next a series of questions was included in the questionnaire to get a sense of the
participants’ experiences traveling and living in places other than Tabi. These questions included
how many years participants had lived in Tabi, distance their family lived from Tabi when they
were born, farthest distance they had lived from Tabi, and farthest distanced traveled from
Tabi. In addition, I included several questions about the participants’ treatment preferences and
practices for common illnesses and their perceived interest in medicinal plants to understand
better their individual motivations and interests.

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27 I used straight line distances because there was too much variability in the potential routes taken by road
and it was not known which roads existed at the time of travel.
I used separate Guttman scales to measure relative economic prosperity and lifestyle because both variables require multiple indicators and the nature of the variables is suitable for scaling. Guttman scales measure whether an individual has a set of items or traits and if they are obtained in a particular order (Guest 2000, Guttman 1944). If the items or traits are acquired in a particular order, then we know that we are measuring the unidimensional variable of interest (Bernard 2002). If the items do scale, then the analysis provides one number for each participant that represents how economically prosperous they are, or how modern their lifestyle is, compared to the other individuals interviewed.

To determine which items to include in the Guttman scale, I recorded information about economic prosperity and lifestyle from observations I made and questions I asked in casual conversation. In addition, my research assistants and I asked people how they could identify someone who is economically affluent and someone who is poor in the community and what the defining characteristics are for people who are traditional and for people who are modern. I selected the items that were common among the majority of the responses and included those in the scales. In addition, I spoke with a few key informants and asked them to identify and describe the least and most well-off families and the least and most traditionally peasant families in the community. I used that information to create a list of items, which consisted of type of housing, material items, and animals, from which to create the Guttman scale (cf. Table 3-4 for list of items). I selected five items from that list that were likely to scale to form the Guttman scale. The respondents were asked to respond whether or not they had those items in their household. I also formed a list of items from several categories including language, entertainment, food, clothing, housing, and material items to use in the creation of the lifestyle Guttman scale (cf. Table 3-5 for list of items). Six items that were likely to scale were selected.
for the lifestyle Guttman scale. The respondents were asked to respond affirmatively or negatively to the items in the scale based on their own lifestyle.

**Network Surveys to Measure Relational Variables**

SNA is different from other types of social science research because it uses relational data instead of individual attribute data to explain variation in attitudes, beliefs, knowledge, and behavior (Scott 2000). Relational data focuses on the relations between individuals, examples of which are connections, ties, or attachments between pairs of people that when combined form a system known as a network. SNA can be used to study the presence, composition, structure, and operations of social networks (Wellman 1999). Social networks can be systematically studied through whole (sociometric) or personal (ego-centered) network analysis. In whole network analysis researchers describe the pattern of relationships between people in a group by collecting data on the relational ties between members of that group (Wellman 1999). This strategy can be used to define the social structure of a group such as a village, organization, or nation-state. Social structure is defined as the patterned organization of people within a network and the relationships between those people (Wellman 1999). In personal networks the focus is on how an individual’s network affect their attitudes, beliefs, and behaviors (Wellman 1999). Data are collected from individuals (egos) about their interactions with their network members (alters). Personal network analysis provides composition data, which is a summary of the attributes of network alters, and structural data, which are summary measures of the patterns of relations. Together they provide a set of variables that describe the social environment surrounding an individual.

Not every person within a network is connected to every other person, and the strength of the relationships between people tends to vary. As a result, when a network is graphed, the nodes (which represent people) and the ties (which represent the relationships between the people)
group together in different ways depending on the questions asked to elicit ties between people during data collection. The groups that form within the network are referred to as clusters, which are defined as areas within a graph where there is a relatively high density of ties between the nodes (Scott 2000). Density is defined as the number of actual ties between individuals divided by the number of possible ties within a network (Scott 2000).

In this research I carried out both whole network and a personal network analyses. The whole network questionnaire consisted of two questions that were asked to each participant about every other participant in the study. Since I had access to all the names of community members, I decided to use the roster approach to foster the participants’ recall (Bernard 2002, Wasserman and Faust 1994). First, each informant was asked if they ever asked each other participant in the study about medicinal plants. Then they were asked what their relationship was to the participants they said they had asked about medicinal plants.

Originally I planned to ask the informant if they spoke with every other participant about medicinal plants. When I pretested the question, however, I found that people were only responding positively if they asked the member of the other household about medicinal plants and not vice versa. Therefore it was essentially the same question I used in the final questionnaire except it was less specific, which could have resulted in more uncontrolled variation in responses. In the final questionnaire I decided not to ask the informant which of the participants had asked them about medicinal plants. I decided it would be harder for people to recall all the people who asked them about medicinal plants versus remember those whom they had asked. Also, this interview technique is tedious and the addition of another question would have been excessive.
The personal network analysis questionnaire consisted of two questions as well. In the first question I asked them to tell us the names of all the people outside of Tabi they had asked about medicinal plants. In the personal network analysis interviews I decided to use the free-recall approach because I did not know the membership roster of each participant’s personal network (Wasserman and Faust 1994). Then I asked them what their relationship was with the person.

**Conclusion**

This research project had an unstructured data collection phase used to gather information the ethnomedical conditions experienced by community members, the types of medicinal plants used to treat those illnesses, and how they prepared the remedies. Data were also gathered to help inform the questions created for the second stage of the project. The methods used during the unstructured phase of research were participant observation, free-listing, open-ended questionnaires, and ethnobotanical specimen collections. The second stage of research I tested hypotheses related to the distribution of medicinal plant remedy knowledge and the influence of attribute and relational variables on the distribution of that knowledge. Methods such as CCA, demographic household surveys, and whole and personal networks were used to gather data to test the hypotheses. Other processes such as site selection, gaining community support, hiring research assistants, acquiring a sampling frame, obtaining informed consent and compensating participants, and selection of participants were explained at the beginning of the chapter. Chapter 4 focuses on the distribution of medicinal plant remedy knowledge in the community.
Table 3-1. Accession numbers, family, scientific name, collection date, and collectors’ initials for the plant species from common remedies collected and deposited in herbaria.

<table>
<thead>
<tr>
<th>#</th>
<th>Family</th>
<th>Scientific name</th>
<th>Date</th>
<th>Collectors’ initials*</th>
</tr>
</thead>
<tbody>
<tr>
<td>21, 22</td>
<td>Anacardiaceae</td>
<td><em>Spondias purpurea</em> L.</td>
<td>7/10/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>12</td>
<td>Apocynaceae</td>
<td><em>Tabernaemontana amygadalifolia</em> Jacq.</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>9</td>
<td>Apocynaceae</td>
<td><em>Thevetia gaumeri</em> Hemsley</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>48</td>
<td>Asphodelaceae</td>
<td><em>Aloe vera</em> (L.) Burm. f.</td>
<td>7/25/07</td>
<td>A.H., G.C.P., L.C.K.</td>
</tr>
<tr>
<td>49</td>
<td>Asteraceae</td>
<td><em>Artemisia vulgaris</em> L.</td>
<td>7/25/07</td>
<td>A.H., G.C.P., L.C.K.</td>
</tr>
<tr>
<td>8</td>
<td>Boraginaceae</td>
<td><em>Heliotropium angiospermum</em> Murray</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>1</td>
<td>Caricaceae</td>
<td><em>Carica papaya</em> L.</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>36</td>
<td>Chenopodiaceae</td>
<td><em>Dysphania ambrosioides</em> (L.) Mosyakin &amp; Clemants</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>60</td>
<td>Convolvulaceae</td>
<td><em>Turbina corymbosa</em> (L.) Raf.</td>
<td>11/15/07</td>
<td>A.H., G.C.P., L.C.K.</td>
</tr>
<tr>
<td>#</td>
<td>Family</td>
<td>Scientific name</td>
<td>Date</td>
<td>Collectors’ initials*</td>
</tr>
<tr>
<td>----</td>
<td>----------------</td>
<td>-----------------------------</td>
<td>------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>33</td>
<td>Euphorbiaceae</td>
<td>Euphorbia gaumeri Millsp.</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>26</td>
<td>Euphorbiaceae</td>
<td>Ricinus communis L.</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>14</td>
<td>Lamiaceae</td>
<td>Ocimum campechianum Mill.</td>
<td>7/10/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>59</td>
<td>Lauraceae</td>
<td>Persea americana Mill.</td>
<td>7/25/07</td>
<td>A.H., G.C.P., L.C.K.</td>
</tr>
<tr>
<td>4</td>
<td>Lythraceae</td>
<td>Punica granatum L.</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>34</td>
<td>Malvaceae</td>
<td>Abelmoschus moschatus Medik.</td>
<td>7/19/07; 11/15/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.; A.H.</td>
</tr>
<tr>
<td>37</td>
<td>Meliaceae</td>
<td>Trichilia hirta L.</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>5</td>
<td>Menispermaceae</td>
<td>Cissampelos pareira L.</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>18</td>
<td>Moraceae</td>
<td>Maclura tinctoria (L.) D. Don ex Steud.</td>
<td>7/10/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>31</td>
<td>Musaceae</td>
<td>Musa x paradisiaca L.</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>11</td>
<td>Myrtaceae</td>
<td>Psidium guajava L.</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
</tbody>
</table>
Table 3-1. Continued

<table>
<thead>
<tr>
<th>#</th>
<th>Family</th>
<th>Scientific name</th>
<th>Date</th>
<th>Collectors’ Initials*</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>Olacaceae</td>
<td><em>Ximenia americana</em> L.</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>6</td>
<td>Phyllanthaceae</td>
<td><em>Phyllanthus ferax</em> Standley</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>50</td>
<td>Rubiaceae</td>
<td><em>Coffea arabica</em> L.</td>
<td>7/25/07</td>
<td>A.H., G.C.P., L.C.K.</td>
</tr>
<tr>
<td>25</td>
<td>Rubiaceae</td>
<td><em>Hamelia patens</em> Jacq.</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>3</td>
<td>Rutaceae</td>
<td><em>Citrus aurantium</em> L.</td>
<td>7/9/07</td>
<td>A.H., G.C.P., R.P.S.</td>
</tr>
<tr>
<td>29</td>
<td>Rutaceae</td>
<td><em>Ruta graveolens</em> L.</td>
<td>7/19/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
<tr>
<td>17</td>
<td>Urticaceae</td>
<td><em>Urera baccifera</em> (L.) Gaudich. ex Wedd.</td>
<td>7/10/07</td>
<td>A.H., G.C.P., L.C.K., R.P.S.</td>
</tr>
</tbody>
</table>

*The collectors were the principal investigator Allison Hopkins (A.H.), the research assistants Guadalupe Chan Poot (G.C.P.) and Layda Chan Ku (L.C.K.), and individuals from Tabi who were knowledgeable about locating medicinal plants Rosario Pech Sarabia (R.P.S.) and Teodora Poot Cuxim (T.P.C.).
Table 3-2. The illnesses and corresponding scientific names constitute the remedies used in the medicinal plant exam. The results from the medicinal plant exam were used to measure individual distribution of knowledge. Remedies from the free-list activity were remedies known by more than one individual in Tabi. The rest of the remedies were not reported by individuals in Tabi and were used to avoid response bias.

<table>
<thead>
<tr>
<th>Illness</th>
<th>Scientific name(s)</th>
<th>From free-list</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acne</td>
<td>Jatropha gaumeri Greenm.</td>
<td>No</td>
</tr>
<tr>
<td>Acne</td>
<td>Momordica charantia L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Asthma</td>
<td>Crescentia cujete L.</td>
<td>No</td>
</tr>
<tr>
<td>Asthma</td>
<td>Gossypium hirsutum L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Canker sores</td>
<td>Jatropha curcas L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Canker sores</td>
<td>Mentha x piperita L.</td>
<td>No</td>
</tr>
<tr>
<td>Colic</td>
<td>Citrus limonia Osbeck</td>
<td>No</td>
</tr>
<tr>
<td>Colic</td>
<td>Urera baccifera (L.) Gaudich. ex Wedd.</td>
<td>Yes</td>
</tr>
<tr>
<td>Cough</td>
<td>Persea americana Mill.</td>
<td>Yes</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Callicarpa acuminata Kunth</td>
<td>Yes</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Manilkara zapota (L.) van Royen</td>
<td>Yes</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Schoepfia schreberi J.F. Gmelin</td>
<td>No</td>
</tr>
<tr>
<td>Dysentery</td>
<td>Hylocereus undatus (Haw.) Britton &amp; Rose</td>
<td>Yes</td>
</tr>
<tr>
<td>Earache</td>
<td>Origanum vulgare L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Earache</td>
<td>Pluchea carolinensis (Jacq.) G. Don</td>
<td>No</td>
</tr>
<tr>
<td>Evil eye</td>
<td>Phyllanthus ferax Standley¹; Abrus precatorius L.²; Ruta graveolens L.³</td>
<td>Yes</td>
</tr>
<tr>
<td>Evil eye</td>
<td>Punica granatum L.</td>
<td>No</td>
</tr>
<tr>
<td>Eye pain</td>
<td>Ocimum basilicum L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Eye pain</td>
<td>Spondias purpurea L.</td>
<td>No</td>
</tr>
<tr>
<td>Fever</td>
<td>Cymbopogon citratus (DC. ex Nees) Stapf.</td>
<td>No</td>
</tr>
<tr>
<td>Fever</td>
<td>Ricinus communis L.¹; Coffea arabica L.²</td>
<td>Yes</td>
</tr>
<tr>
<td>Gas</td>
<td>Allium schoenoprasum L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Gas</td>
<td>Tecoma stans (L.) Juss. ex Kunth</td>
<td>No</td>
</tr>
<tr>
<td>Headache</td>
<td>Lippia graveolens Kunth</td>
<td>No</td>
</tr>
<tr>
<td>Headache</td>
<td>Manfreda petskinil R. Orellana, L. Hern. &amp; G. Carnevali</td>
<td>Yes</td>
</tr>
<tr>
<td>Itchy skin</td>
<td>Antigonon leptopus Hook. &amp; Arn.</td>
<td>No</td>
</tr>
<tr>
<td>Itchy skin</td>
<td>Trichilia hirta L.</td>
<td>Yes</td>
</tr>
<tr>
<td>No lactation</td>
<td>Cnidoscolus aconitifolius (Mill.) I.M. Johnston</td>
<td>Yes</td>
</tr>
<tr>
<td>No lactation</td>
<td>Heliotropium angiospernum Murray</td>
<td>No</td>
</tr>
<tr>
<td>Parasites</td>
<td>Dysphania ambrosioides (L.) Mosyakin &amp; Clemants</td>
<td>Yes</td>
</tr>
<tr>
<td>Parasites</td>
<td>Solanum lycopersicum L.</td>
<td>No</td>
</tr>
<tr>
<td>Splinter</td>
<td>Citrus aurantium L.</td>
<td>No</td>
</tr>
<tr>
<td>Splinter</td>
<td>Tabernaemontana amygdalifolia Jacq.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

108
Table 3-2. Continued

<table>
<thead>
<tr>
<th>Illness*</th>
<th>Scientific name(s)</th>
<th>From free-list</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snake bite</td>
<td><em>Carica papaya</em> L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Snake bite</td>
<td><em>Ximenia americana</em> L.</td>
<td>No</td>
</tr>
<tr>
<td>Stomach fever</td>
<td><em>Plantago major</em> L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Stomach fever</td>
<td><em>Thevetia gaumeri</em> Hemsley</td>
<td>No</td>
</tr>
<tr>
<td>Toothache</td>
<td><em>Argemone mexicana</em> L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Toothache</td>
<td><em>Euphorbia gaumeri</em> Millsp.</td>
<td>No</td>
</tr>
<tr>
<td>Vomit</td>
<td><em>Abelmoschus moschatus</em> Medik.</td>
<td>No</td>
</tr>
<tr>
<td>Vomit</td>
<td><em>Artemisia vulgaris</em> L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Warts</td>
<td><em>Croton humilis</em> L.</td>
<td>Yes</td>
</tr>
<tr>
<td>Warts</td>
<td><em>Ocimum campechianum</em> Mill.</td>
<td>No</td>
</tr>
</tbody>
</table>

*See Chapter 4 for extensive descriptions of the reported causes, symptoms, preventative and curative techniques, and seriousness of the illnesses listed here.
Table 3-3. The illness names listed in Maya are the illnesses treated by herbal remedies that were included in the medicinal plant exam. The exam was used to measure the individual distribution of herbal knowledge in Tabi. The illness glosses in Spanish and English are terms that best describe the illness listed in Maya.*

<table>
<thead>
<tr>
<th>Illness name in Maya</th>
<th>Illness gloss in Spanish</th>
<th>Illness gloss in English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mejen chuchun</td>
<td>Granos</td>
<td>Acne</td>
</tr>
<tr>
<td>K’aak’as se’en</td>
<td>Asma</td>
<td>Asthma</td>
</tr>
<tr>
<td>K’áak’</td>
<td>Fogajes</td>
<td>Canker sores</td>
</tr>
<tr>
<td>Ch’ot nak’</td>
<td>Cólico</td>
<td>Colic</td>
</tr>
<tr>
<td>Saasa’ kaal</td>
<td>Tos</td>
<td>Cough</td>
</tr>
<tr>
<td>Waach’ k’aja’al</td>
<td>Diarrea</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>K’iik’ nak’</td>
<td>Disentería</td>
<td>Dysentery</td>
</tr>
<tr>
<td>K’i’inan xikin</td>
<td>Dolor de oído</td>
<td>Earache</td>
</tr>
<tr>
<td>K’ak’as ich</td>
<td>Mal de ojo</td>
<td>Evil eye</td>
</tr>
<tr>
<td>K’i’inan ich</td>
<td>Dolor de ojo</td>
<td>Eye pain</td>
</tr>
<tr>
<td>Chokuil</td>
<td>Calentura</td>
<td>Fever</td>
</tr>
<tr>
<td>Chi’ibal pool</td>
<td>Dolor de cabeza</td>
<td>Headache</td>
</tr>
<tr>
<td>Saak’</td>
<td>Comezón</td>
<td>Itchy skin</td>
</tr>
<tr>
<td>Mina’an u k’abu yiim</td>
<td>No Lactación</td>
<td>No lactation</td>
</tr>
<tr>
<td>U yik’el u nak’ máak</td>
<td>Bichos en el estómago</td>
<td>Parasites</td>
</tr>
<tr>
<td>K’i’ix</td>
<td>Espina</td>
<td>Splinter</td>
</tr>
<tr>
<td>Chi’ibal kaan</td>
<td>Mordedura de serpiente</td>
<td>Snake bite</td>
</tr>
<tr>
<td>Uyiik’al nak’</td>
<td>Aire en el estómago</td>
<td>Stomach air</td>
</tr>
<tr>
<td>Chokuil nak’</td>
<td>Calentura en el estómago</td>
<td>Stomach fever</td>
</tr>
<tr>
<td>K’i’inan koj</td>
<td>Dolor de muela</td>
<td>Toothache</td>
</tr>
<tr>
<td>Xej</td>
<td>Vómito</td>
<td>Vomit</td>
</tr>
<tr>
<td>Ax</td>
<td>Verrugas</td>
<td>Warts</td>
</tr>
</tbody>
</table>

*See the “Characteristics of Illnesses Treated with Common Herbal Remedies” section in Chapter 4 for a discussion of Maya illnesses and glosses.
Table 3-4. Items used to develop a relative economic prosperity Guttman scale. The scale was used to measure differences in economic prosperity between individuals in Tabi.

<table>
<thead>
<tr>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>“American” pigs</td>
</tr>
<tr>
<td>Bathroom</td>
</tr>
<tr>
<td>Bees</td>
</tr>
<tr>
<td>Blender</td>
</tr>
<tr>
<td>Block house</td>
</tr>
<tr>
<td>Cattle</td>
</tr>
<tr>
<td>Cement or tile floor</td>
</tr>
<tr>
<td>Electric or gas stove</td>
</tr>
<tr>
<td>Fowl</td>
</tr>
<tr>
<td>Lamb</td>
</tr>
<tr>
<td>Ranch</td>
</tr>
<tr>
<td>Refrigerator</td>
</tr>
<tr>
<td>Stereo</td>
</tr>
<tr>
<td>Store</td>
</tr>
<tr>
<td>Television</td>
</tr>
<tr>
<td>Tricycle or bicycle</td>
</tr>
<tr>
<td>Van, car, or motorcycle</td>
</tr>
<tr>
<td>Wardrobe</td>
</tr>
<tr>
<td>Washing machine</td>
</tr>
</tbody>
</table>
Table 3-5. Items used to develop a traditional lifestyle Guttman scale. The scale was used to measure differences in lifestyles between individuals in Tabi.

<table>
<thead>
<tr>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy machine-made tortillas</td>
</tr>
<tr>
<td>Drink maize meal drinks (<em>maseca</em>)</td>
</tr>
<tr>
<td>Drink traditional maize drinks (either <em>atole</em> or <em>pozole</em>) every day</td>
</tr>
<tr>
<td>Eat bread made of wheat</td>
</tr>
<tr>
<td>Listen to Radio Peto</td>
</tr>
<tr>
<td>Own a bed</td>
</tr>
<tr>
<td>Own a house with a thatch roof</td>
</tr>
<tr>
<td>Own a house without a thatch roof (eg., cement block or tin roof)</td>
</tr>
<tr>
<td>Own a low stool</td>
</tr>
<tr>
<td>Own plastic chairs</td>
</tr>
<tr>
<td>Speak Maya</td>
</tr>
<tr>
<td>Speak more in Spanish than Maya</td>
</tr>
<tr>
<td>Speak more in Spanish than Maya with your children</td>
</tr>
<tr>
<td>Speak Spanish</td>
</tr>
<tr>
<td>Think more in Spanish than Maya</td>
</tr>
<tr>
<td>Watch movies or television programs</td>
</tr>
<tr>
<td>Wear a button-down shirt</td>
</tr>
<tr>
<td>Wear a hat</td>
</tr>
<tr>
<td>Wear a shawl (<em>reboso</em>) when you leave your house</td>
</tr>
<tr>
<td>Wear a slip (<em>justan</em>) every day</td>
</tr>
<tr>
<td>Wear a traditional dress (<em>hipil</em>) every day</td>
</tr>
<tr>
<td>Wear jeans</td>
</tr>
<tr>
<td>Wear pants or a miniskirt (instead of a knee-length skirt or an <em>hipil</em>)</td>
</tr>
<tr>
<td>Wear plastic sandals (<em>Duramils</em>)</td>
</tr>
<tr>
<td>Wear shoes of tire and rope</td>
</tr>
<tr>
<td>Work in the maize field (<em>milpa</em>)</td>
</tr>
<tr>
<td>Worked outside of Tabi</td>
</tr>
</tbody>
</table>
CHAPTER 4
MEDICAL ETHNOBOTANY

Although ethnobotanical research has been going on for millennia (Johns 1990, Sumner 2000, Ungar and Teaford 2002), the term ethnobotany was not officially employed until Harshberger (1896) used it to describe his work in a presentation in 1895. Since ethnobotany’s inception as a self-aware discipline, four phases of research have developed, none of which are mutually exclusive. The four phases are utilitarian, ethnoscience, ethnoecology, and participatory (Hunn 2002b). Harshberger and other early ethnobotanists took a utilitarian approach to their research; their studies were descriptive and focused on how humans used plants. The results of this research were lists of plants with descriptions of their uses.

In the 1950s, starting with the doctoral dissertation of Conklin (1954a), some ethnobotanists stopped focusing entirely on the botany of useful plants and started incorporating anthropology and psychology into their research. These ethnoscience studies focused on how human beings viewed or conceived of plants and animals and how they classified information about them (Berlin, Breedlove, and Raven 1966, Conklin 1954b). Two decades ago research in ethnobotany became more quantitative in nature and shifted to focus on ethnoecology issues, such as how much and in what way people use the local environment (Carneiro 1978, Pinedo-Vásquez et al. 1990, Prance et al. 1987) and the relative cultural significance of different plants (Johns, Kokwaro, and Kimanani 1990, Phillips and Gentry 1993a, Phillips and Gentry 1993b, Trotter and Logan 1986). The goals of studies focused on these issues tended to be conservation or drug discovery, respectively. In general these studies were more ecological in nature. Currently there is ethnobotanical research done on all of the aforementioned topics with a particular emphasis on quantitative ethnobotany, including the study of individual ethnobotanical knowledge variation (cf. Reyes-Garcia et al. 2007 for review). Ethnobiological research is also
becoming more participatory with indigenous and local peoples assisting in the design and implementation of research projects on TEK issues (Hunn 2002b). This approach allows members of local communities to determine how their knowledge is presented to the outside world, and they are able to incorporate their own needs and interests into research projects.

Historically, anthropologists presented different aspects of culture as if they were universally shared within ethnic groups while typically the variation that existed was ignored (Boster 1985, Ellen 2003). Sapir (1938) first formally acknowledged the importance of systematic variation in cultural knowledge in the 1930s. Not until the 1960s, however, did the idea become widely accepted that the variation within a cultural group is patterned and can be studied to provide a more nuanced understanding of culture (Boster 1987, Pelto and Pelto 1975, Roberts 1961, Roberts 1964, Wallace 1961). In the 1970s the first studies were done on intra-cultural variation in biological knowledge (Ellen 1979, Gardner 1976, Hays 1976). Since then interest in researching the influence of individual attributes to predict their ethnobotanical knowledge has greatly increased. For example, in a review article Reyes and colleagues (2007) found a 9% increase in publications measuring intra-cultural ethnobotanical knowledge variation between the years 1986 and 2005 with an increase from six articles during the period of 1996 to 2000, to 23 articles between 2001 and 2005.

Intra-cultural variation in ethnobotanical knowledge exists within and between domains. Some of the domains in the discipline are wild plants, non-timber forest products, food plants, firewood, construction material, ornamentals, and medicinal plants. The results from research focused on these different domains are often unique to the domain (Reyes-Garcia et al. 2007) because of varying degrees of access, motivation, and abilities to acquire and categorize
information by people (Boster 1991). Therefore it is important to distinguish between domains and to report the limitations of making comparisons between them (Reyes-Garcia et al. 2007).

The focus of this study is on the domain of medicinal plants because people in rural areas with limited access to scientific medicine depend on traditional medicine for their primary health care (Hoff 1995). Also, in rural areas where people have access to scientific medicine they tend to continue to use traditional medicine along with the adoption of scientific medicine (Hoff 1995, Hopkins 2003). Researchers have determined that individual knowledge of medicinal plants varies quite a bit within communities (Barrett 1995, Casagrande 2002, Garro 1986).

To understand variation in knowledge of medicinal plants in Tabi it is necessary to understand the traditional health care system within which that knowledge is situated. In the current study, two approaches—ethnomedical and ethnobotanical—were used to help understand traditional medicine in Tabi. The ethnomedical approach, unlike other approaches in medical anthropology, studies the traditional health care system from an emic perspective by focusing on how different populations think about disease and how they explain the cause of sickness and local treatment choices. Medical ethnobotany was employed to better understand which herbal treatments are used to treat the signs and symptoms of illnesses. The result of combining the ethnomedical approach and medical ethnobotany was a more holistic understanding of illnesses and the herbal treatments for those illnesses used by local people (Waldstein and Adams 2006).

A goal of this study was to contribute to the body of literature on medical ethnobotany in the Yucatan by systematically collecting and analyzing data on herbal remedies known by non-specialists. The majority of past research focused on specialist knowledge and was descriptive in nature (cf. Ankli 2000 for a notable exception). To my knowledge there has been no systematic study of intra-cultural knowledge variation in the Yucatan. Actually, only one of the eight studies
published on individual knowledge variation in the domain of medicinal plants between 1986 and 2005 was carried out in Latin America (Reyes-Garcia et al. 2007). This particular chapter is dedicated to the description of the distribution of medicinal plant remedy knowledge in Tabi. More specifically, it provides a review of the literature, results, and discussion of the test of the hypothesis that many people in Tabi know a few remedies and many remedies are known by a few people.

**The Maya Medical System**

Health and disease are conceptualized in different ways by different cultures based on the peoples’ relationship with the natural world, empirical investigation, and the conceptual and religious ways they understand the world (Garcia, Sierra, and Balam 1999). Garcia, Sierra, and Balam (1999), three scientific medical doctors, wrote a book about the Maya medical system based on their experience learning from traditional healers in the states of Yucatan and Campeche between 1989 and 1996. I found many congruencies in what Garcia and colleagues wrote and my own experiences in Tabi. I also found that the medical system, as described in their book, was a useful framework for understanding the ethnomedical conditions treated by herbal remedies in this study. I will briefly describe the Maya medical system and common causes of illness (cf. Garcia, Sierra, and Balam 1999 for a more detailed description of Maya traditional health care).

The Maya medical system, like many other traditional medical systems, is holistic in nature (Worsley 1982). In the medical system, as is in the belief system of the Maya culture in general, there is an intricate connection between the individual, society, the natural, and the supernatural (Garcia, Sierra, and Balam 1999). Actions taken by the individual affect other

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1 I did not do systematic data collection on the medical system used in Tabi; however, I did collect ethnographic data on the topic.
people, animals, plants, objects, weather, planets, the universe, and gods and other supernatural forces, and changes made by these external variables influence the individual. The Maya conceptualize health as a state of equilibrium where constantly fluctuating external variables are in balance with constantly changing internal elements of the body. Illness ensues when the external and internal elements lose their balance. Preventative and curative methods are normally focused on returning the body to equilibrium.

The Maya conceptualization of the body is closely linked with their understanding of the cosmos (Garcia, Sierra, and Balam 1999). Of particular interest here is the belief that there are two vital principles in the body: the pixan (the soul) and the ool (the life force). The soul enters the fetus during pregnancy and leaves at the time of death. It resides principally in the head, although it can be found throughout the body. At death, the soul is reincarnated as an animal or another human being. The life force enters the body through the process of breathing. It also is found throughout the body, but its home is the heart. Its purpose is to rule over the state of health, provide the body’s strength, and ensure emotional balance. People with weak life forces are believed to be more susceptible to certain illnesses such as evil eye and fear.

There are many variables, both natural and supernatural, that may cause the body to lose equilibrium and consequently result in illness in an individual. Physical causes include fluxes of heat and cold, careless eating habits, bad hygiene, bad posture and quick movements, excessive work, lack of rest, weakness, and emotional state (Garcia, Sierra, and Balam 1999). Supernatural causes are related to the influence of the “winds” produced either voluntarily or involuntarily by people, animals, plants, objects, or supernatural beings on the life energy of the person (Anderson 2003, Garcia, Sierra, and Balam 1999).
The Maya classify many things based on their thermal quality including plants, portions of the body, air, food, and beverages (Garcia, Sierra, and Balam 1999). One of the most common physical causes of imbalance in the state of the body was fluxes of hot and cold in both Tabi and other areas of the Yucatan Peninsula (Anderson 2003, Garcia, Sierra, and Balam 1999). This explanation of the causes and how to prevent diseases is called the hot-cold disease system theory and is common throughout Mexico and Latin America (Browner 1985a, Foster 1984, Whiteford 1995). This system originated from Greek and Persian humoral pathology, which was adopted by the Spanish and brought to Latin America at the time of the conquest (Foster 1987). Humoral pathology was disseminated throughout Latin America through formal medical education, hospitals, pharmacies, missionaries, and guides for home medical treatment. Although the understanding of health and illness does seem to coincide with the hot-cold disease system theory, research has shown that the actual selection of medicinal plants by the Yucatec Maya is based on sensory properties like taste, smell, color, form, and texture of the plant instead of thermal characteristics (Ankli, Sticher, and Heinrich 1999b).

**Ethnomedical Conditions and Herbal Treatments**

The previous section focused on a description of the aspects of the Maya traditional medical system, which is the framework in which knowledge of herbal remedies is acquired and used. The purpose of this section is to explain the components of common herbal remedies in Tabi.

**Characteristics of Illnesses Treated with Common Herbal Remedies**

The illnesses described in this section are those that correspond with the most common remedies reported in the free-listing exercise. Some participants responded in Yucatec Maya and others in Spanish. The Yucatec Maya terms were translated into Spanish and then English with the help of translation dictionaries and individuals fluent in Maya and Spanish. Exact translations
were not always available for illness terms in Maya, so Spanish and English scientific medical
glosses were used to represent an illness category rather than a specific illness. One example of
this is diarrhea. In the case of each illness, the English term is provided along with the Yucatec
Maya term in parentheses.

The remedies that were free-listed in this study were based on 107 different illnesses. I
separated the illnesses from the plants used to treat them and ran the data through AnthroPac.
The frequency of illnesses mentioned ranged from 2.5% to 87.5%. The three most frequent
illnesses—diarrhea (waach’ k’aja’al), parasites (u yik’el u nak’ máak), and dry cough (saasa’
kaal)—were reported by 88%, 80%, and 70% of the respondents, respectively. These illnesses
were common in Tabi and herbal remedies were often used to treat them. Sixty-five percent of
the illnesses were listed by two or more people whereas 35% were listed by only one person. The
illnesses listed by only one person tended to be uncommon and/or those not often treated with
herbal remedies in Tabi.

Although formal ethnomedical explanatory models (cf. Berlin and Berlin 1996) were not
performed for each health condition because this was not the focus of the study, information
about the causes, symptoms, methods of prevention, treatment options, and seriousness of illness
were obtained through semi-structured interviews. Then the illnesses were grouped into
categories using information from four illness pile sorts done by individuals within the
community and similarities in responses to the semi-structured interview. The illness categories
used were the same as Heinrich and colleagues’ (1998) to facilitate comparison. For each illness
group, I provided a range of the percentage of people who included the illnesses in that group in
their free-list. Some people may have included the illness more than once in their free-lists but,
the frequency of each illness is based on how many different people reported the illness. In
addition, I provided a measure of the overall frequency of the group of illnesses by calculating the total illness frequency within each particular illness category (Table 4-1).

The largest group of ailments in terms of number of illnesses and frequency of occurrence in the free-list were gastrointestinal disorders; there are 10 illnesses in this group and 26.6% of the total number of illnesses free-listed were gastrointestinal. This group included diarrhea (waach’ k’aja’al), parasites (u yik’el u nak’ máak), vomiting (xej), dysentery (k’iik’ nak’), colic (ch’ot na’), stomachache (chi’ibal nak’), chill in the stomach (t’u kee), stomach air (uyiik’al nak’), gastritis (ele’ nak’), and stomach fever (chokuil nak’). The illnesses are listed in frequency of occurrence in the illness free-lists; their frequencies ranged from 7.5% to 87.5%. Five of the top 10 most frequently listed ailments were gastrointestinal. The reason the participants gave for grouping these ailments together is because they all occur in the stomach and many of them are caused by the same things. The general causes reported for gastrointestinal disorders were eating bad food including expired, rotten, unripe, and undercooked food, junk food, and food that had not been washed properly. Other general causes were overeating or not eating when hungry, consuming cold beverages while overheated, poor hygiene including not washing hands after going to the bathroom and before eating, abrupt changes in weather, and arguing or being frightened. The symptoms of this group of illnesses include pain or a burning sensation in the stomach or intestines, gas, bloating or inflammation in the abdominal region, lack of appetite, lethargy, nausea and vomiting, and diarrhea. Practices to prevent gastrointestinal illnesses are directly related to the causes and include only eating foods that have been washed and cooked properly and are not expired or rotten, drinking water that has been boiled or chlorinated, using proper hygiene, eating when hungry, and taking care not to drink cold water while overheated. Common treatments of gastrointestinal illnesses were the use of herbal remedies and
pharmaceuticals. Most of the illnesses in this group were considered serious in nature because vomiting and diarrhea can lead to dehydration and death, especially in young children.

The next largest group in terms of number of illnesses classified was pain or febrile diseases with 11.4% of the total frequency of illnesses free-listed in this category. This group included earache (k’i’inan xikin), toothache (k’i’inan koj), headache (chi’ibal pool), and canker sores (k’áak’) presented in the order of frequency of occurrence in the free-lists. The frequency of occurrence ranged from 32.5% to 62.5%. The causes of the illnesses in this set vary quite a bit; they include illnesses such as flu, fever or a cough, not keeping the specific area clean, anxiety or excessive worry, eating excessive amounts of inappropriate foods such as junk food or acidic fruits, excessive exposure to hot weather, and/or a fall or a physical blow or introduction of an object to an area of the body. The symptoms, however, tend to be shared throughout the group with pain or discomfort in the localized area, which is sometimes accompanied by swelling and/or redness. General methods of prevention are keeping clean, not eating foods that are problematic, limiting exposure to the sun and heat, and trying to remain calm during times of stress. The participants reported visiting the scientific medical doctor and using pharmaceuticals more frequently than the use of herbal remedies with this group of ailments. In general the illnesses in this group tend not to be serious, although if the problem persists, then perceived gravity tends to increase.

Of the total ailments free-listed, 9.8% were dermatological such as bumps (k’áak’), warts (aax), hair loss (liubul ts’otsel pool), burns (chuujul), itchiness (saak’), dandruff (caspa), and splinters (k’i’ix). These ailments ranged from 10% to 57.5% of the participants including them in their free-lists. General causes for ailments in this group include insect bites, touching plants that cause dermatitis, changes in climate or hot weather, eating disagreeable foods such as expired
perishable goods or foods that cause allergic reactions, epidemics like chicken pox, coming into contact with hot things through spilling or getting too close to fire, touching wood that splinters, not washing hair, and weakness of the person’s life force. Itchiness, burning sensation, redness, pain, bumps on the skin, and hair loss are all general symptoms of these illnesses. Preventative measures include using insect spray, not touching plants that cause dermatitis or bumps on the skin, avoiding fire and taking care when working with hot items, not eating foods that cause allergic reactions, wearing shoes, and washing hair regularly with shampoo. The tendency for treatment of this type of ailment is the use of herbal remedies. These ailments tend not to be grave except for burns, which can be serious depending on their severity.

Respiratory ailments, including cough (saasa’ kaal) and asthma (k’aak’as se’en), made up 6.1% of the illnesses free-listed. The range in frequency of these illnesses was 32.5% to 70%. The general causes for respiratory infections were reportedly any of the following occurring while an individual has a sore throat: consumption of cold liquids and foods, bathing with cold water, changes in climate and exposure to humid weather, exposure to wind, and working or playing with cold water. Reported symptoms for illnesses in this category include a sore throat, difficulty breathing, raspy voice, fluid in chest, fever, and coughing. Ways of preventing respiratory ailments are not eating or drinking cold things, not playing with water, limiting exposure to wind when showing symptoms of a respiratory infection, and bathing with lukewarm water. Participants generally reported using pharmaceuticals for coughs but, herbal remedies for asthma. The seriousness of the illnesses in this group varies; a cough is not considered serious but it is believed to be able to develop into asthma, which is considered serious because it can cause death.
Urological illnesses including kidney stones (piedra) and bladder infections (yaya’ wix) constituted 3.1% of illnesses on the free-lists. Kidney stones and bladder infections were mentioned by 32.5% and 25% of the people who free-listed, respectively. Both illnesses are thought to be caused by stones formed in several possible ways, including not urinating when the bladder is full, drinking water with sediments, drinking water that has melted from ice, eating salty foods, changes in weather, and a genetic predisposition. The symptoms for a bladder infection are a burning sensation when urinating, frequent urination, and urinating very little at a time. Stomachache, back pain, and difficulty walking are taken to be symptoms of kidney stones. Preventative measures include urinating when the bladder is full and not drinking water with sediments. Herbal remedies and scientific medicine, including surgery, are all used to treat these illnesses. Both illnesses are believed to be serious, especially kidney stones, which are believed to be potentially fatal if left untreated.

A few gynecological/andrological illnesses were mentioned in the free-list including infertility (utuul ko’ole maa tu paa tu ts’iik paal), cessation of a mother’s milk (mina’an u k’abu yiim), and a chill in the blood (k’iik’ pasmado). Of the total incidence of free-listed illnesses, 2.8% were these three illnesses. The range of participants who included illnesses in this category was 5% to 27.5%. Some reported causes for infertility-related ailments were getting wet or exposed to wind when overheated, especially when the wind or water is cold. Other causes are drinking cold beverages like coconut water, papaya juice, or lemonade when overheated or during menstruation, a genetic predisposition, and taking certain bitter-tasting pharmaceuticals like penicillin. The symptoms include body ache, black blood, headache, fever, pain in the breasts, and/or lack of maternal milk. Ways to prevent the ailments include not drinking cold beverages when overheated and staying inside or covering up when going out, especially while
menstruating. Treatments vary from home remedies, herbal or otherwise, to going to the scientific medical doctor. An especially popular remedy for treating a chill in the blood is performing tok, a form of acupuncture that is used to draw blood. These illnesses are considered serious because a chill in the blood can cause infertility and/or death, and the absence of breast milk leaves women with little choice but to feed formula to their babies, which can be dangerous because of the use of contaminated water.

Diabetes (ch’ujuk wix) is an endocrinal disorder that fits into Heinrich and colleagues’ (1998) other/unclassified category. At least one treatment for diabetes was included in 42.5% of participants’ free-lists; but, only 2.5% of the total occurrence of illnesses free-listed was diabetes. Causes of diabetes included excessive worry, fighting, getting chilled, watching a lot of television, genetic predisposition, and eating a lot of sweets. Some symptoms of the illness are headache, constant hunger and thirst, wounds that do not heal, dizziness, temporary blindness and flashing lights in vision, buzzing in the ears, teeth falling out, lethargy, and frequent urination. Some ways to prevent this illness are not eating sweets or fatty foods, not drinking soda, not bathing with cold water, and not fighting with people. The treatment for this disease is visiting the doctor and following medical recommendations. This illness is believed to have no cure and to be very serious because it can cause death.

Evil eye (k’ak’as ich) is classified as a personalistic illness because it is believed to be caused by supernatural forces, whereas the illnesses previously described are generally considered to be caused by natural events (Foster and Anderson 1978). Evil eye is thought to be caused by a person who is overheated, hungry, drunk, pregnant, or has a blemish in their eye looking at a baby. The symptoms are vomiting, one eye appearing smaller than the other,

2 Heinrich and colleagues (1998) classified this as a culture-bound syndrome.
lethargy, thirst, green or blue excrement, diarrhea, soft skin, and lack of appetite. There are a few ways to prevent this illness including covering the baby’s head when leaving the house or when getting close to someone and performing the sign of the cross over the baby’s body with the rue plant (*Ruta graveolens* L.) occasionally. This illness was always reported as being treated with herbal or other non-pharmaceutical home remedies. It is believed to be serious because it can kill a baby. Of the illnesses recorded in all the free-lists, 2.4% were evil eye. Remedies to treat evil eye were included by 40% of the participants in their free-lists.

The next groups of illnesses are those caused by poisonous animals, such as snakes. Walking on frequently traveled paths and weeding the area around the house are ways of preventing snake bite (*chi’ibal kaan*). In the case of snake bite, herbal remedies are usually used to slow the spread of venom while the patient is taken to the hospital. There are cases, however, where snake bites were treated only with the use of herbal remedies. Snake bites are considered serious because they kill some people. Of the people interviewed, 40% reported at least one herbal remedy for snake bite. Of all the illnesses reported in the free-lists, 2.4% were snake bites.

Of the total items free-listed, 2.4% fit into the fever (*chokuil*) category. Some reported causes are flu, dysentery, cough, insect bites, vaccinations, getting wet when sick with the flu or when overheated, overworking, and changes in the weather. Headache, lack of appetite, bad mood, lethargy, and body ache are all symptoms of fever. Some preventative measures are not touching cold water or bathing when sick. Although people prefer to use pharmaceuticals or *tok* to treat fever, 30% of participants still reported herbal remedies for treatment of this illness. Fever is considered serious because it can lead to permanent weakening of the body.

Ophthalmological illnesses, such as eye pain (*k’i’inan ich*), are the last category of illness; only 1.8% of the free-listed illnesses fit in this category. Some reported causes of eye pain are
illnesses such as flu and cough, anxiety, headache, accidents such as falling or something entering the eye, poor eyesight, tiredness, time of year, crying, and being overheated. There are several general symptoms such as swelling, redness, upper and lower eyelids sticking together, itchiness, tears, pain, and a burning sensation in the eye. One preventative measure people take to avoid eye pain is not leaving the house when overheated. Treatments include home remedies, including herbal, or visiting the doctor. Remedies for eye pain were reported by 30% of the informants. In general, it is not considered a serious illness.

Many of the causes and preventative techniques for illnesses reported in Tabi fit within the hot/cold classification system common throughout Mexico and Latin America (Browner 1985a, Foster 1984, Ingham 1970, Mathews 1983, Redfield and Villa Rojas 1934, Whiteford 1995). In summary, common causes of hot-cold imbalance in the body and subsequent illness include consumption of certain foods and beverages, weather conditions (especially wind), transitions of the body from heat to cold, patterns of work and rest, and the state of heat and cold of others when encountered.

The Maya have many rules relating to these common causes of imbalance to which they prescribe daily with the intention of preventing illness. I was constantly warned against a variety of behaviors that could throw my body out of hot and cold balance, including eating cereal with cold milk in the morning and leaving the house in the morning too quickly after waking up because the body is warm just after waking up. In addition, I was warned against bathing with cold water when I was overheated. Other examples of precautions frequently taken by villagers include waiting until the afternoon to wash clothes by hand, not drinking cold beverages at even a hint of a sore throat, covering up with a shawl or towel when leaving the house if it is rainy or cloudy, not allowing children prone to asthma or heart conditions to leave the house if it is
cloudy and looks like rain, and not using fans to cool the body, presumably because of the role wind is perceived to play in causing illness.

When performing a diagnosis in addition to asking about symptoms, traditional healers often ask the patients a variety of questions about consumption patterns, behaviors, their mental state, interactions with other individuals, exposure to weather, observance of customs related to illness prevention, and their relationship with the supernatural (Garcia, Sierra, and Balam 1999). The patient’s responses help the person treating them determine if the illness is naturalistic or personalistic and what is the most effective means of treating it. This method of diagnosing illness is more holistic than is generally practice by scientific medical doctors insofar as it incorporates aspects of the mental, physical, social, and supernatural environments in which the patient is situated.

Some factors influencing treatment choice are illness characteristics, caretaker characteristics, and structural and infrastructural conditions. The diagnoses that caretakers assign to illnesses sometimes affect what treatment individuals seek, since some treatments are not effective at treating illnesses with certain causes. For example, illnesses that are considered to be caused by supernatural forces are only treated with traditional medicines because scientific medical doctors do not recognize supernatural illnesses and thus they are not able to treat them effectively (Garcia, Sierra, and Balam 1999). Seriousness is another illness characteristic that plays a role in determining what treatment to use. In general the more serious an illness is perceived to be, the more likely the family will be to seek outside help (Garro 1998a, Garro 1998b, Mathews and Hill 1990, Ryan and Martinez 1996, Weller, Ruebush, and Klein 1995, Whiteford 1995, Young 1980, Young 1981). Fever, for example, is considered serious in Tabi because it can lead to permanent weakening of the body and people prefer to seek treatment from
a scientific medical doctor. Asthma is also considered a very serious illness that can cause death, but people tend to seek the help of traditional healers because scientific medical doctors have a history of being ineffective at treating asthma.

Characteristics of the caretaker reportedly are associated with health and illness behaviors (Ryan 1995). Several researchers argue that caretaker social demographic factors such as age, sex, and formal education affect their treatment selection (Kroeger 1983, Rhoades 1984). For example, there is a preference by caretakers in Tabi with a large number of children to utilize herbal remedies in the home before seeking outside treatment options to contain costs. Younger community members tend to seek treatment from scientific medical doctors because they do not have the patience to learn the traditional remedies and they are not willing to wait for them to take effect. A traditional healer in Tabi confirmed that herbal remedies are considered a slower method of treating illness, but he argued that they are safer because they are not as invasive as scientific medical procedures. The example he gave was the kidney stones. He has a remedy that breaks the stones up after 15 days and allows them to pass through the urethra. The recommended method by scientific medical doctors is surgical removal of the stones. Surgery is considered very dangerous by the villagers because it is believed to result in a permanent weakening of the body and an inability to do manual labor, which is necessary for survival.

Structural and infrastructural conditions—including the availability and cost of treatment, transportation, and the stability of the national health care system—tend to influence treatment choices (Garro 1998a, Mathews and Hill 1990, Spring 1980, Whiteford 1995, Young 1981). Availability is definitely a factor in selecting treatments in Tabi. An example of this is in the treatment of a poisonous snake bite. Usually snake bites occur in areas that are far from a hospital; therefore many people treat the bite immediately with herbal remedies to slow the
spread of the venom, giving them time to arrive at the hospital for further treatment. Although Tabi and other nearby towns have SSY health care clinics and medical interns (pasantes) and there is a hospital in Merida where community members have free access, most people believe the health care offered in these facilities is substandard. In addition, the clinic in Tabi frequently does not have the medicines people are prescribed and there is a general belief that the medicines there are not as strong as those that can be purchased at privately owned pharmacies. As a result, people sometimes prefer to use medicinal plants because they are perceived to be more effective than the free scientific medical health care and the cost is minimal compared to paying for a private practice doctor’s visit and pharmaceuticals.

Although there are some general trends regarding illness treatment decision-making, it is important to note that the method of selecting treatments is extremely flexible and the use of both scientific medicine and traditional medicine is common in all households in Tabi to varying degrees. In general, people try the treatment that worked in the past; if that treatment does not work, they will try something else. For example, a woman in Tabi fell and hurt her ankle and decided to visit the doctor. The doctor treated her ankle, but two weeks later her ankle had still not improved, so her mother came and treated her using herbal remedies.

**Characteristics of Plants Used in Common Herbal Remedies**

Fifty-seven plant species from 37 different families were used in common herbal remedies in Tabi (Table 4-2). The majority (10.53%) of the commonly used medicinal plant species in Tabi were members of the Euphorbiaceae. This family is found worldwide except for Antarctica and has many economic uses such as food, seed oil, latex, purgative, and ornamental (Heywood et al. 2007). It is a relatively large family with 222 genera and 5,970 species (Stevens 2008); there are, however, some much larger families such as Asteraceae, Fabaceae, Orchidaceae, and Rubiaceae.
Lamiaceae, Malvaceae, and Rutaceae were the next most frequent plant families with 8.77%, 5.26%, and 5.26% of the plant species, respectively. Timber (e.g., teak), culinary herbs (e.g., mint), fiber (e.g., cotton), ornamentals (e.g., hollyhocks), and fruits (e.g., citrus) are the most well-known uses for plants in these families (Heywood et al. 2007). Lamiaceae and Malvaceae both have worldwide distribution, and Rutaceae is found in northern temperate and tropical areas and the Southern Hemisphere.

Apocynaceae, Asteraceae, Bignoniaceae, Olacaceae, Plantaginaceae, Poaceae, and Rubiaceae represented 3.51% each of the plant species used as medicines. Poaceae, Asteraceae, and Rubiaceae are large and economically important plant families composed of species used as food (e.g., lettuce, maize, wheat), cooking oil (e.g., sunflower), herbs (e.g., tarragon), beverages (e.g., coffee), ornamentals (e.g., asters), herbal remedies (e.g., arnica, calendula, chamomile, quinine), medicine (e.g., artemisinin), fodder (e.g., various grasses), and building materials (e.g., bamboo) (Heywood et al. 2007). The rest of the families are not as economically important, but they do have plants used for their edible leaves (e.g., borage), medicine (e.g., Plantago), ornamentals (e.g., trumpet vine), and timber (e.g., tallow wood). The families vary in distribution from worldwide to temperate or pan tropical.

Lastly, there were many families that had only one of the commonly reported medicinal plant species (1.75% of the total each); those families were Agavaceae, Amaryllidaceae, Anacardiaceae, Annonaceae, Asphodelaceae, Boraginaceae, Cactaceae, Caricaceae, Chenopodiaceae, Convolvulaceae, Cucurbitaceae, Fabaceae, Lauraceae, Lythraceae, Meliaceae, Menispermaceae, Moraceae, Musaceae, Myrtaceae, Papaveraceae, Phyllanthaceae, Polygonaceae, Sapotaceae, Solanaceae, Urticaceae, and Verbenaceae. The distribution of most of these plant families is pan tropical, although some are found nearly worldwide and, in a few
families, the species are mostly found in temperate regions (Heywood et al. 2007). These families have a variety of species that are used economically for fiber (e.g., sisal), food (e.g., potatoes, spinach, mulberries, bananas, soursop, papaya, squash, rhubarb, beans, cashews), beverages (e.g., tequila), spices (e.g., cinnamon, bay laurel, clove), timber (e.g., mahogany, neem, *Eucalyptus*), medicine (e.g., curare), ornamentals (e.g., cacti, crepe myrtle, daffodils, *Verbena*), oil (e.g., sassafras), drugs (e.g., opium), and latex (e.g., chicle).

Nearly 30% of the common names used for the plants by people in Tabi were exclusively Spanish. Almost the same percentage (29%) of plant species are native to Europe, Asia, and Africa with the other seventy-one percent native to the Yucatan (Bailey 1949, Hernández-Sandoval, Orellana, and Carnevali 2008, PNP 2008, Stevens et al. 2001, Steyermark and Williams 1946-1977). This suggests that the Maya have incorporated species introduced since the Spanish Conquest into their pharmacopeia while maintaining their Spanish names. The majority (85%) of the common medicinal plant species are also reportedly used in other areas of the Yucatan Peninsula3 (Anderson 2003, Ankli 2000; Table 4-3).

Common medicinal plant species can be grouped in four life forms recognized by the Yucatec Maya: trees (*che’*), herbs (*xiíw*), vines (*aak’*), and grasses (*su’uk*). Trees are large woody plants, herbs are small herbaceous plants, vines are both long and flexible plants, and grasses are plants that grow in flat open grasslands that are used for thatch roofs (Brown 1979). Fifty-six percent of the species are trees; herbs (30%), vines (11%), and grasses (3%) make up the remainder. Ninety-three percent of the plants were available for procurement in village and 3.5% of the species were found in secondary forest and *milpa* within 2 km of the village. These findings correspond with the preference for procuring medicinal plants in disturbed habitats and

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3 This figure is based on a comparison with published medical ethnobotanical studies conducted in the Yucatan Peninsula within the last 10 years.
a tendency to utilize more accessible plants (Casagrande 2002, Stepp and Moerman 2001). Sixty-five percent of the plants were considered abundant by a key informant while 35% were considered scarce, at least at the beginning of the rainy season\(^4\). The relatively high percentage of abundant species fits with what is commonly found in medicinal plant studies, which is that abundant plants are more frequently used as medicinal plants (Stepp and Moerman 2001). Thirty-nine percent of the species were reported by the key informant as having other uses such as food, beverages, flavoring, jewelry, and containers (Table 4-4).

**Characteristics of Common Herbal Remedies**

Many different plant parts are used in herbal remedies and they vary in their preparation and administration. Traditionally Maya healers prepared medicinal plants as salves, balms, tinctures, and syrups. Other preparation methods such as extractions, oils, capsules, and soaps have been added to their repertoire as a result of exposure to other healing traditions (Garcia, Sierra, and Balam 1999). The non-specialists in Tabi use five preparation methods to prepare common medicinal plant remedies including infusions, extracts, plasters, soaks, and decoctions, which were used in 46%, 39%, 10%, 2.5%, and 2.5% of the remedies, respectively. Infusions are the most common method for preparing medicinal plants in Tabi as in other areas of the Yucatan and around the world (Anderson 2003). They are generally prepared by boiling leaves in water. The liquid is then left to cool and the plant matter is strained out. Infusions tend to be ingested, but they are sometimes also administered as a liquid suppository, in baths, or topically to the afflicted area.

\(^4\) The percentage of perceived scarce plants is somewhat higher than expected for commonly used medicinal plants. The perceived scarcity may be a result of me asking the key informant about scarcity at the very end of the dry season; many tree species are deciduous and lose their leaves and herbaceous plants often wane during the dry season.
Extracts are almost as common as infusions in Tabi. They are prepared using physical extraction methods such as toasting, cutting, crushing, squeezing, chewing, or rubbing the plant matter to extract the juices, resin, or gel. Extracts are usually applied externally to the area of interest, but in some cases they are mixed with liquid and ingested or ingested alone. Plasters are quite a bit less common but are still utilized occasionally. Plasters sometimes require no preparation and other times they are heated before being applied externally. Plasters are applied either to the part of the body that is affected by the illness or to a part of the body believed to correspond to the affected body part.

Soaks and decoctions, infrequent preparation methods, typically involve crushing tough plant parts, such as seeds, roots, bark, or tubers, and then submerging them in water at room temperature for several hours. Often it is necessary to cook down the ingredients by boiling them in water to successfully extract the chemical components from the plant. Once boiled in water, the material is strained out of the liquid and the decoction is ingested or applied as a liquid suppository.

In addition to the various preparation methods, there are four methods of application including ingestion, topical application, baths, and suppositories. Ingestion and local application are most common, accounting for 43% and 42% of applications, respectively. Baths and suppositories are only reported 8% and 5%, respectively.

People in Tabi use a variety of plant parts in herbal remedies. By far the most common plant part used is leaves, which are used 50% of the time in common remedies. Roots and resins are the next most common plant parts, which are used in 16% and 14% of the remedies, respectively. Some less frequently used plant parts are fruits (9%), bark and wood (6%), and
The least common plant parts used are seeds and flowers, both of which were used in only 1% of the remedies.

To compare the prevalence of medicinal plant remedies in different illness categories from the free-list data, I calculated informant consensus using Trotter and Logan’s (1986) Informant Agreement Ratio (IAR). The IAR is summarized in the following formula:

\[
\text{IAR} = \frac{\text{Total frequency of ailment} - \text{Number of separate remedies for ailment}}{\text{Total frequency of ailment} - 1}
\]

The calculation was performed separately for each illness category. The main difference between this approach and CCA, which is used as the main analysis in this study to measure agreement, is that CCA uses factor analysis to weigh the responses of participants who more frequently agree with each other. An IAR value close to one indicates a high agreement on which remedies are used to treat the ailments found in the illness category by the people who reported remedies in that category. A value close to 0 indicates a lot of variation in which plants are used to treat the illnesses in the illness category. The results from this analysis were compared with the findings from research with traditional Yucatec Maya, Nahua, and Zapotec healers in southern Mexico presented in an article by Heinrich and colleagues (1998).

The illness category with the highest value was cardiovascular diseases, with a value of 1. This value, however, is overrepresentative of consensus because there were only two people who reported remedies and only one plant was reported to treat cardiovascular disease. Therefore it should not be interpreted as widespread agreement. The low number of people reporting plants to cure cardiovascular disease corresponds with the results from the Yucatec Maya and Nahua healers, who reported no plants used to treat cardiovascular disease. Other use categories that had

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5 I used this method because Heinrich and colleagues (1998) used it and I wanted to compare our findings. One of the reasons I chose to use CCA to measure consensus in this study is because it does not overrepresent consensus like the IAR measure.
relatively high values were gastrointestinal (0.84), poisonous animals (0.77), respiratory illnesses (0.69), and urological illnesses (0.67). Dermatological ailments (0.65), ophthalmological problems (0.65), gynecological/andrological issues (0.60), and culture-bound syndromes (0.58) had medium values. The lowest values were in the following use categories: pain/febrile (0.49), fever (0.48), other (0.42), and skeletal-muscular (0.33). Some of these categories might have an under-representation of consensus because of the tendency of people to mix plants to treat an illness. Herbal remedies tend to have a few core plants, but the other plants vary considerably depending on the informant. All of these complementary plants are listed individually, which increases the total number of plants and decreases consensus. An example of this is black pepper (*Piper nigrum* L., Piperaceae), found in 10 different remedies for reproductive problems with one remedy having a frequency of two and the rest with a frequency of one. In addition, in the free-list data, plants are listed with their common names. This means that some plants may be the same species but are listed separately, increasing the number of taxa.

High consensus values tend to be in categories with common ailments (Heinrich et al. 1998). The gastrointestinal category had the highest IAR score for the Nahua and Maya healers and residents of Tabi, 0.68, 0.71, and 0.84, respectively. The higher competence score among Tabi residents may be because they tend to share medicinal plant information more than herbalists, especially with common ailments such as gastrointestinal illnesses. The occurrence of gastrointestinal illnesses, such as parasitism and diarrhea, is common in subsistence farming communities in developing countries because there is often limited access to potable water, lack of sewers, and houses with dirt floors (Berlin, Berlin, and Stepp 2004). Respiratory ailments had a fairly high value for Maya healers and residents of Tabi. Respiratory ailments are also fairly common in subsistence farming communities because of the tendency for houses to lack much
protection from the weather and the high exposure to smoke from cooking fires (Berlin, Berlin, and Stepp 2004). Although dermatological ailments are common, the consensus value was relatively low for Maya and Nahua healers and the Maya general public. This may be because high amounts of experimentation are done with remedies for dermatological disorders, as is the case with the Mixe, an indigenous group inhabiting the eastern highlands of Oaxaca, Mexico (Heinrich et al. 1998). Or it may be because dermatological conditions are so common (due to lack of access to water, poor hygiene, and extreme heat) that people forget to mention remedies to cure them or have learned to live with the conditions and no longer try to cure them (Berlin, Berlin, and Stepp 2004).

It is not surprising that fever has a fairly low value because people prefer to visit the doctor to treat this illness; thus there is likely less sharing of medicinal plant remedy knowledge between community members. Fever, skeletal-muscular ailments, and culture-bound syndromes were not treated as separate categories by the Maya healers because of the difficulty in distinguishing them from other ailments (Ankli, Sticher, and Heinrich 1999a). In Tabi there were few remedies reported that I was able to classify as skeletal-muscular and culture-bound syndromes, and both categories had fairly low consensus values. In addition, the “other” category for Maya and Nahua healers and residents of Tabi had a low value, which is not surprising because of the great variety of types of illnesses and plants to treat them that were included in this category.

**Distribution of Common Medicinal Plant Remedy Knowledge**

The rest of the chapter is dedicated to understanding the distribution of knowledge in Tabi. The first part describes a theoretical model to help understand the distribution of knowledge in the community. The second part is a description of the distribution of medicinal plant remedy knowledge in Tabi.
Information Economy Model: A Framework for Understanding Variation in Socially Acquired Knowledge

Boster’s (1991) information economy model (IEM) is a useful framework for understanding patterned variation in knowledge. Boster (1991:204) summarizes the IEM as follows:

Because culture is learned, both the degree of sharing and the pattern of sharing cultural knowledge reflect the quantity, quality, and distribution of individuals’ opportunities to learn. The character and distribution of learning opportunities are, in turn, determined by the characteristics of the learners, the nature of the knowledge domain, and the ways in which the domain is learned.

The model can be better understood by breaking it down into its various parts, starting with the features that influence the degree and pattern of sharing of cultural knowledge.

The amount of cultural knowledge shared is based on characteristics of learning opportunities. Opportunities to learn range in quantity from frequent to sporadic. These opportunities also vary in quality; good-quality learning opportunities include unrestrained, consistent, and repetitive information. The amount of sharing of cultural knowledge and the quality and quantity of learning opportunities are positively related to one another; the greater availability of higher-quality information leads to easier learning, higher average individual knowledge, and higher consensus between individuals (Boster 1991, D'Andrade 1995).

The IEM identifies quantity and quality of learning opportunities as important factors in the distribution of individual knowledge. The amount of cultural knowledge about medicinal plants tends to be shared less than other types of ethnobotanical knowledge because there are fewer learning opportunities. For example, people tend to gather food plants and firewood almost daily, whereas medicinal plants are normally only gathered when there is an illness event. In

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6 The type of cultural knowledge treated in the IEM is beliefs that people consider factual. Beliefs that are influenced by self-interest, such as opinions, are not included in the IEM.
addition, there is more variation in medicinal plant remedy knowledge because the variety of plants used for medicine tends to be large compared to uses for food, industrial purposes, and ornamentals (Anderson 2003). Furthermore, people continue to experiment with medicinal plants (Anderson 2003, Heinrich et al. 1998, Johns, Kokwaro, and Kimanani 1990) whereas other plant use categories tend to be less dynamic. The quantity of learning opportunities often varies between households because the number of illness events in a family varies, as does the preference for using medicinal plants versus other forms of health care. In addition, the frequency of illness events differs based on the size of the family, the types of foods they consume, and the rigor of the preventative measures they practice. If there is an illness event in the family and they plans to treat it with an herbal remedy, the adults often send children to look for the plants necessary for the remedy. If there are no knowledgeable adults in the family, they will seek advice from other family members and friends.

The quality of medicinal plant learning opportunities also varies between families. Remedies that are effective at treating prevalent illnesses are well known throughout the community because the information learners receive related to that remedy is consistent and repetitive. For example, one woman told me that her children helped her treat stomachaches with the same medicinal plants so much that they are now able to self-medicate. She told me that one night her son woke up with a stomachache. He tried to wake her but she remained asleep, so he got up with his sister and found the plants they knew treated stomachache. They prepared the remedy and he drank it and felt much better afterward. Gastrointestinal illnesses are the most common illnesses treated with medicinal plants in Tabi, and the remedies to treat them are also the ones with the most consensus.
Learners receive less consistent and repetitive information for illnesses that are less common or for illnesses for which there are no effective remedies. One example of this in Tabi is diabetes. Although the prevalence of diabetes is rising, it is still not common. Many people told me there is no cure for diabetes and the vast majority of remedies free-listed for diabetes were only given to me by one person. Therefore people learning about medicinal plants are not likely to regularly hear about treatments for diabetes because of lack of people with the illness. In addition, the information transmitted about diabetes tends to be inconsistent because of the wide number of plants employed by different people to try to treat this uncommon illness. The IEM predicts that there will be little consensus for herbal remedies when information is not consistent or repetitive, which are the general trend with data from Tabi.

According to the IEM, the distribution of cultural knowledge varies from widely shared among individuals to clustering by groups (Boster 1991). Opportunities to learn are potentially available to everyone or only available to those in certain groups such as kin groups, groups based on sexual division of labor, and religious groups (D'Andrade 1995). The distribution of cultural knowledge and the distribution of learning opportunities are positively related to one another; the more widespread the learning opportunities, the easier it is to learn, the higher the average individual knowledge, and the greater the consensus between individuals (Boster 1991). Verbal transmission of information tends to result in clustering of information by social groups (D'Andrade 1995), whereas acquisition through direct experience is generally more evenly distributed (Boster 1991).

The concept of knowledge clustering in Tabi and therefore clustering of learning opportunities is treated in more detail in Chapter 5. In general, however, the data shows that

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7 Twenty-four remedies were free-listed for the treatment of diabetes of which 20 were only listed by one person and the most frequently reported remedy was only listed by six people.
common medicinal plant remedy knowledge is not clustered by groups in Tabi. The lack of clustering is likely a result of the small size of the community where people are often forced to ignore differences, such as membership in different religious or political organizations, because of the small number of knowledgeable individuals on any given topic. The general trend of adults in a household working together to decide how they are going to treat an illness also results in less clustering of information.

The second half of the IEM focuses on the factors that influence the character and distribution of learning opportunities. The first factor is the characteristics of the individual, which includes the inherent characteristics of individual learners and the interrelationships among these individuals. Inherent characteristics are things that influence individuals’ chances and drive to learn information and skills (Boster 1991). Individuals’ drive to learn may be influenced by their social roles, while their chances to learn may be a result of their age and experiences (Boster 1991). The influence of inherent characteristics will be addressed in more detail in Chapter 5, but in general it appears that people in Tabi learn the bulk of medicinal plant remedy knowledge only after they have children because their motivation to learn greatly increases. Others learn for more particular reasons like a love for plants, a desire to help others, a need for income, and a perceived gift for healing.

The nature of the domain is the second factor influencing the character and distribution of learning opportunities. Boster (1991) identifies four types of domains ranging from observable to unobservable. The first two domains are composed of items that are directly observable with one defined based on morphological attributes and the other on functional attributes. An example of the first type of domain is plants and an example of the second type is tools. The third domain is only observable through its effects. An example of this type of domain is disease. The last type
of domain consists of entities that are unobservable such as deities. Knowledge in observable
domains can be acquired through direct experience. Thus the distribution of knowledge should
reflect to some extent the quantity and quality of the information available for the individuals to
experience in the domain (Boster 1991). Knowledge that is indirectly observable or unobservable
tends to be acquired verbally, and thus the distribution of knowledge in those domains should be
confined to the distribution of opportunities to learn about the domain and therefore reflect the
social communication network (Boster 1991).

The nature of the domain of medicinal plant remedies is a bit complicated because it is
composed of medicinal plants and the illnesses those plants are used to treat. If the domain just
consisted of medicinal plants, then it would be entirely observable through morphological and
functional features. Medicinal plants are often observed and selected based on their
morphological and other observable sensory characteristics such as smell (Brett 1994, Brett
Shepard Jr. 1996, Shepard Jr. 2004). Ankli and colleagues (1999b) showed that people use taste
and odor of plants as indicators of what type of illnesses the plants are effective in treating. The
functional aspect of the plant is also an important factor in selecting plants for this domain.
Biochemists have found that many of the medicinal plants used by the Maya do indeed have
biochemical properties that are effective at curing the ailment for which they are utilized
(Anderson 2003). Ankli and colleagues (1999b), for example, found that plants used by the
Maya for medicine tend to be astringent, meaning they have disinfecting properties that are
effective at treating gastrointestinal disorders. The other aspect of this domain is illnesses which,
unlike plants, are only observable through their symptoms. Furthermore, the effective treatment
of an illness by a medicinal plant is only observable through the removal of the symptoms. For
example, I observed that a baby stopped having diarrhea and vomiting a few minutes after her mother gave her an infusion made with sour orange (Citrus aurantium L.) leaves. After witnessing that I am likely to assume that sour orange is an effective treatment for diarrhea and vomiting. In addition, sometimes people have no experience with an illness or a remedy and they must rely on the experience of others. Thus aspects of this domain are both observable and unobservable, which means that both the quantity and quality of information, along with social network, can influence the distribution of knowledge.

The third factor that influences the character and distribution of learning opportunities is how people learn. People acquire knowledge through direct observation, verbal transmission, and inference from what they already know. Boster (1991) argues that the relative importance of these three ways of learning depends on the sources of structure in experience that lead to shared comprehension. He identifies five sources of structure (Boster 1991:210). The first source of structure, “inherent in the natural world,” is determined entirely by nature. The next three sources of structure, “imposed on human experience by our characteristics as perceiving, thinking, and feeling beings,” “interaction with an environment structured by deliberate human action,” “regularities in human social interaction,” are influenced by the social and cultural environment in which an individual is raised and allows for a basic level of cultural knowledge to be acquired (Hunn 1989). The majority of complex cultural knowledge comes from the fifth source of structure, which is “social transmission of information through a symbol system” (Hunn 1989).

Studies on general ethnobotanical knowledge acquisition suggest that most people start learning as young children and reach basic adult competence by adolescence (Hewlett and Cavalli-Sforza 1986, Hunn 2002a, Ohmagari and Berkes 1997, Reyes-Garcia et al. 2005, Stross
Adults continue to gain ethnobotanical knowledge as need arises, especially in cases where learning opportunities are limited as children (Casagrande 2002, Ohmagari and Berkes 1997). The specific case of medicinal plant remedy knowledge acquisition seems to differ somewhat from other types of ethnobotanical knowledge in that although it also begins in childhood (Prince et al. 2001), it is much more of a lifelong process (Anderson 2003, Phillips and Gentry 1993a). This difference may be because of the greater complexity in learning how to collect, prepare, and administer medicinal plant remedies than plants in other use categories (Phillips and Gentry 1993a), the larger number of plants used as medicine versus other ethnobotanical domains (Anderson 2003), and the increased motivation people experience to learn about herbal remedies once they have children (Prince et al. 2001). It also may be that medicinal plant remedy knowledge is more susceptible to acculturation (Phillips and Gentry 1993a), which often leads to delayed knowledge acquisition (Ohmagari and Berkes 1997).

Most children raised in subsistence farming communities, including Yucatec Maya children, acquire ecological knowledge and skills through situational learning (Gaskins 1999, Hunn 2002a, Zarger 2002b). Situational learning is when information is transmitted during the practice of activities that are part of everyday life (Gaskins 1999). Examples of these activities are weeding and harvesting in fields and gardens, caring for animals, and searching for plants to treat sick relatives (Gaskins 1999, Hunn 2002a). A study of Luo children’s medicinal plant knowledge in Kenya also found that medicinal plant knowledge, at least in part, is learned through situational learning, in particular the observation of illness and participation in its treatment both for themselves and with family and friends (Prince et al. 2001). Although I did not systematically study children’s medicinal plant knowledge acquisition, I did encounter some

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8 None of this research has been done with a specific focus on medicinal plants.
children who learned medicinal plant remedies. I visited several houses where the adults were very knowledgeable about medicinal plants and children as young as five would chime in with answers regarding which plants are used to treat which illnesses. These children had more opportunities to witness the use of herbal remedies on themselves and their siblings and they were often required to collect the medicinal plants.

Knowledgeable grandparents often are sources of information on medicinal plants for their grandchildren. Among the Luo in Kenya healers often taught their grandchildren about herbal remedies (Prince et al. 2001). This situation also occurs in Tabi, although less frequently. I visited one house where a boy in his early teens was able to identify almost all the common medicinal plants I showed him in photos. His grandfather is a healer in the village and the boy helps him collect plants and make remedies. The other two healers did not appear to be explicitly teaching any of their grandchildren about medicinal plants. I found that children have particularly strong memories of remedies with they perceived as relieving them from an ailment. For example, while conversing with one women I asked her if a tomato (Solanum lycopersicum L.) can be used for burns. The woman called her five-year-old daughter into the room and asked her what to use on burns, to which she answered, “tomato.” The little girl had been severely burned and her mother had treated her with tomato.

Although there is medicinal plant learning opportunities for children in Tabi, there are many factors that can limit these opportunities, the most widespread being regular attendance at school. For example, one morning I visited a young mother and her baby suddenly had diarrhea and started vomiting. She quickly prepared and administered a tea. Only the woman’s second-youngest child was there to participate and learn from the treatment of her baby sister; the two

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9 I had been told this by someone else in the community.
older siblings missed out on the learning opportunity because they were at school. The direct impact of school attendance, however, may not be as important as other more indirect influences such as a change in values. Direct influences are limited because children are usually only in school for four hours (7:00 a.m.–11:00 a.m.) and their after-school activities, such as assisting their parents in household tasks, provide them opportunities to learn about medicinal plants. Another factor that limits learning opportunities is the growing tendency of teenagers to quit school after sixth grade and commute to the city for work. In both cases children spend less time participating in traditional daily tasks, which results in fewer opportunities to learn. The prevalence of medicinal plant use within the family also influences learning opportunities, as does motivation. Prince and colleagues (2001) found in a rural community in Western Kenya that although children between the ages of 12 and 15 were quite knowledgeable about medicinal plants, they tended to agree among themselves less than adults and they only knew how to treat common illnesses with simple remedies whereas adults also knew complicated remedies and remedies for less-common illnesses. These findings suggest that children continue to learn into adulthood. They also found that variation in knowledge among adults seemed to be related to differences in experience, especially motherhood (Prince et al. 2001). Thus learning about medicinal plants in some communities appears to be a lifelong endeavor (Anderson 2003, Phillips and Gentry 1993a, Prince et al. 2001).

People in Tabi generally gained the majority of their herbal remedy knowledge after they had children. In a subsample of 20 individuals, 10% learned the majority of what they know about medicinal plants as children and 90% learned the majority of what they know about herbal remedies after they were married and had children. People in Tabi seek advice about medicinal plants most frequently from relatives, including in-laws. Sixty-six percent of respondents in the
network questionnaire were asked by relatives, including in-laws, about medicinal plants. Of those who were asked about medicinal plants, 58% were from an older generation, 29% from the same generation, and 11% from a younger generation\textsuperscript{10}. In addition to relatives, 21% of the people sought for advice were widely recognized as knowledgeable about medicinal plants. The remaining 13% were neighbors, friends, and acquaintances.

The factors that typically influence the way individuals learn are the opportunities they have to directly experience and experiment with their environment and learn through those experiences. Researchers report that people tend to explore their plant environment and utilize what plants are available to them (Johns, Kokwaro, and Kimanani 1990, Prince et al. 2001). In addition, people often learn about medicinal plants through observation and instruction from family members during participation in relevant activities, such as curing events (Casagrande 2002).

**Distribution of Medicinal Plant Remedy Knowledge in Tabi**

The application of IEM to Tabi suggested that learning opportunities vary based on a variety of reasons discussed in the previous section. Thus I expected that the cultural consensus model will capture variation in common medicinal plant remedy knowledge between households. I found there were 650 different remedies free-listed. The frequency of people who reported each remedy ranged from 1 to 20 out of the 40 interviewed, and 84% of the remedies were reported by only one individual and therefore was not the focus of further analysis\textsuperscript{11}. The percentage of shared remedies reported was 26%. The most commonly reported remedies were reported by 50%, 37.5%, 27.5%, and 25% of the people (Figure 4-1). The average number of remedies free-

\textsuperscript{10} In 2% of the cases it was unknown what generation the family member was in relation to the participant.

\textsuperscript{11} I believe that this large amount of individual knowledge is a product of my strict definition of a remedy.
listed per person was 23 with a range from two to 88 (cf. Table 4-5 for a list of the common remedies).

I also rely information on the proportion of people who reported the plants that compose the remedies because most researchers report on plants instead of remedies; thus this information can be used for comparative purposes. The remedies were composed of 276 different names of plants. Berlin, Breedlove, and Raven (1966) did a study on the correspondence between the Tzeltal Maya folk taxonomy and the standard Linnean classification system. They found that of the plants with a moderate to high cultural significance, 24.3% of them were underdifferentiated\textsuperscript{12}, 42.6% had a one to one correspondence, and 33.1% were overdifferentiated\textsuperscript{13}. Based on these percentages, the remedies are composed of roughly 298 botanical species, which means that the 276 different names of plants is slightly lower but close to the estimated number of species used in the remedies\textsuperscript{14}. Since the number of plant names and the estimated number of species is close I am able to compare the results with findings from other studies on plant frequencies.

The proportion of people who reported each of the plant name as being used in a remedy ranged from 2.5% to 82.5% (Figure 4-2). In general, the pattern shows few plant names known by many people and numerous plants known by a few people. This pattern fits with other studies on the distribution of medicinal plant knowledge in Latin America and Africa (Barrett 1995, Casagrande 2002, Friedman et al. 1986). The amount of knowledge known by only one

\textsuperscript{12} Underdifferentiated is defined as one Tzeltal specific that encompass two or more plant species.

\textsuperscript{13} Overdifferentiated is defined as two or more Tzeltal specifics corresponding to one plant species.

\textsuperscript{14} Berlin, Breedlove, and Raven (1966) provided no information on degree to which the correspondence between botanical species and Tzeltal specifics varies. Calculations are based on the assumption that two botanical species equals one Maya plant name and two Maya plant names equal one botanical species. The number of species could be much higher if the degree of correspondence is greater than two.
individual was 47%. This finding is similar to other studies that found between 40% and 50% of the medicinal plant knowledge the researchers recorded was idiosyncratic (Alexiades 1999, Barrett 1995, Johns et al. 1990, Johns, Kokwaro, and Kimanani 1990). In Tabi, 39% of plant names were reported by more than three people. In other studies the range of plants recognized by more than three people was from 15% to 50% (Barrett 1995, Friedman et al. 1986, Johns et al. 1990). Thus the Tabi data fall within the ranges of plants recognized by people in other studies. Typically not more than three plants are reported by the vast majority of the participants (Barrett 1995, Casagrande 2002). The three most commonly reported plant names in Tabi were provided by 82.5%, 65%, and 55% of the people interviewed.

To further assess the variation in medicinal plant remedy knowledge I ran the responses to the medicinal plant exam through CCA in UCINET, a SNA software (Borgatti, Everett, and Freeman 1999). The analysis was run using two analytical models: multiple choice and covariance with 0.5 proportion true matches. The difference between the two models is that the proportion of matching responses between individuals is corrected for guessing at different levels (cf. Weller 2007 for complete description). The multiple choice model is corrected for one-third and the proportion model for one-half. Differences between the competence scores obtained using these two analytical models indicate response bias. I ran a Pearson correlation in SPSS 16.0 with the competence scores from both analytical models. The results were a correlation coefficient of 0.95 (p<0.01), which indicates there is little difference in competence values using the two analytical models and thus there is limited response bias (cf. Weller 2007 for justification). Although either analytical model can be used to calculate similarity between

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15 I believe these numbers are low because of recall problems. When people were asked if the plants with relative high frequencies in the free-listing were used to cure specific illnesses in the medicinal plant exam, the frequency of yes responses was much higher.
participants with dichotomous (yes-no) responses, I selected the competence values calculated using the covariance model because it was specifically designed to be used with dichotomous variables (Weller 2007). However, it is sensitive to the proportion of yes-no answers; the proportion of yes responses in the data must be between 30% and 70% to eliminate the influence of response bias on the results of the analysis (Weller 2007). The Tabi data meet this criterion with 53% yes responses in the answer key. The ratio between the first factor value (50.54) and the second factor value (3.37) is large (15.01) confirming that the individual competence scores (the first factor values) represent agreement in responses between individuals, which is used as a proxy for knowledge.\(^\text{16}\) The individual competence scores ranged from 0.10 to 0.95, where 0 is no competence and 1 is full competence (Figure 4-3). The mean competence score is 0.63 with a standard deviation of 0.20. This finding confirms the results from the free-list activity that there is quite a bit of variation in knowledge about medicinal plant remedies within Tabi.

There are four possible ways that these data on agreement regarding herbal remedies could be distributed, including 1) universal agreement, 2) random assignment of remedies, 3) agreement determined by social group, and 4) agreement distributed based on individual expertise (Boster 1985). In Tabi there was not total agreement because all competence scores would have been the same if that were the case. There was some agreement, which supports the idea that informants are not randomly assigning plants to the treatment of illnesses. Competence scores were not the same among all members of one social group, such as people with the same religious affiliation\(^\text{17}\). The pattern of agreement found in these data suggest there is one medicinal plant remedy model in Tabi and that people vary in their proficiency of it (Boster

\[^{16}\] An explanation of the details of the model is given in chapter four.

\[^{17}\] Data supporting this finding will be shown in the Chapter 5.
1985). Anderson also found this pattern among the Yucatec Maya in Chunhuhub, Quintana Roo (Anderson 2003). Chapter 5 focuses on the identification and measurement of individuals’ attributes and relationships with others and testing the degree of influence they have on the variation in medicinal plant remedy knowledge in Tabi.
Table 4-1. The illnesses free-listed were classified into general illness categories. The percentage of illnesses in that category out of the total number of illnesses free-listed was calculated to determine the most common types of illnesses treated by medicinal plants. The number of times each illness was included in the free-lists is also reported.

<table>
<thead>
<tr>
<th>Illness category</th>
<th>% of total illnesses free-listed*</th>
<th>Illness name</th>
<th>Frequency</th>
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<td>Vomiting</td>
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<td>Colic</td>
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<tr>
<td></td>
<td></td>
<td>Stomachache</td>
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<tr>
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<td>Chill in the stomach</td>
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<tr>
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<td></td>
<td>Stomach air</td>
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<td>Stomach fever</td>
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<td>Hair loss</td>
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<td>Burns</td>
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<td>Fever</td>
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*The total does not equal 100% because there were many illnesses free-listed that are not included in this group. Only the illnesses from remedies with high frequencies were included.
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<th>#*</th>
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<th>Yucatec Maya name; Spanish name</th>
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*These numbers correspond with the numbers and plants in Table 4-2.*
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<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Mediterranean region</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>32</td>
<td>Yes</td>
<td>Anderson 2003</td>
<td>India</td>
<td>Baily 1949</td>
</tr>
<tr>
<td>33</td>
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<td>Anderson 2003; Ankli 2001</td>
<td>Tropics and subtropics worldwide</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>Species #*</td>
<td>Used in other areas of Yucatan</td>
<td>Used in other areas of Yucatan source(s)</td>
<td>Wild distribution</td>
<td>Wild distribution source</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------</td>
<td>----------------------------------------</td>
<td>-------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>34</td>
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<td>Anderson 2003</td>
<td>Latin America and the Caribbean</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>35</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Latin America and the Caribbean</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>36</td>
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<td>Anderson 2003; Ankli 2001</td>
<td>Latin America, the Caribbean, and Old World Tropics</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>37</td>
<td>No</td>
<td></td>
<td>Latin America and the Caribbean</td>
<td>PNP 2008</td>
</tr>
<tr>
<td>38</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Old World Tropics</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>39</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Tropical and subtropical America</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
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<td></td>
<td>Tropical and subtropical America</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>41</td>
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<td>Ankli 2001</td>
<td>Latin America, the Caribbean, and Old World Tropics</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>42</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Latin America and the Caribbean</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>43</td>
<td>No</td>
<td></td>
<td>Yucatan Peninsula of Mexico, Peten, Guatemala, and Belize</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
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<td>Florida, Mexico through South America, and the Caribbean</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
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<td>Europe</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>46</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>India or Ceylon</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>47</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Unknown</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>48</td>
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<td>Anderson 2003; Ankli 2001</td>
<td>Southern U.S., Mexico, Belize, Guatemala, and El Salvador</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>49</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Tropical Africa</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>Species #</td>
<td>Used in other areas of Yucatan</td>
<td>Used in other areas of Yucatan source(s)</td>
<td>Wild distribution</td>
<td>Wild distribution source</td>
</tr>
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<td>----------------------------------------</td>
<td>-------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>51</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Southeastern Asia and Malaysia</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>52</td>
<td>No</td>
<td></td>
<td>Southeastern Asia and Malaysia</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>53</td>
<td>No</td>
<td></td>
<td>Southern Europe</td>
<td>Bailly 1949</td>
</tr>
<tr>
<td>54</td>
<td>Yes</td>
<td>Ankli 2001</td>
<td>Veracruz to Oaxaca and Yucatan Peninsula in Mexico, Belize, and northern Guatemala</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>55</td>
<td>Yes</td>
<td>Ankli 2001</td>
<td>South America</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>56</td>
<td>Yes</td>
<td>Anderson 2003</td>
<td>Tropical America</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
<tr>
<td>57</td>
<td>Yes</td>
<td>Anderson 2003; Ankli 2001</td>
<td>Southern Texas, Mexico, Guatemala, and Nicaragua</td>
<td>Steyermark and Williams 1946-1977</td>
</tr>
</tbody>
</table>

*These numbers correspond with the numbers and plants in Table 4-2.*
Table 4-4. Information about the plant species including its life form, where it was collected, its perceived abundance by community members, and other uses for it in Tabi

<table>
<thead>
<tr>
<th>Species #</th>
<th>Life form</th>
<th>Location of collection</th>
<th>Abundance</th>
<th>Other uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td>Flavoring for food</td>
</tr>
<tr>
<td>3</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>4</td>
<td>Tree</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Shrub</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Shrub</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Dried fruit used as drinking bowl</td>
</tr>
<tr>
<td>11</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Vine</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>14</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td>Flavoring for food</td>
</tr>
<tr>
<td>16</td>
<td>Vine</td>
<td>1–2 km from village</td>
<td>Abundant</td>
<td>Wine and liquor</td>
</tr>
<tr>
<td>17</td>
<td>Vine</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>18</td>
<td>Shrub</td>
<td>Village</td>
<td>Abundant</td>
<td>Leaves for consumption</td>
</tr>
<tr>
<td>19</td>
<td>Shrub</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Shrub</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Tree</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Tree</td>
<td>&lt;1 km from village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Shrub</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Vine</td>
<td>Village</td>
<td>Scarce</td>
<td>Seeds used for jewelry</td>
</tr>
<tr>
<td>25</td>
<td>Shrub</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Herb</td>
<td>&lt;1 km from village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td>Flavoring for food</td>
</tr>
<tr>
<td>30</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>31</td>
<td>Shrub</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>32</td>
<td>Shrub</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>Species #</td>
<td>Life form</td>
<td>Location of collection</td>
<td>Abundance</td>
<td>Other uses</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>------------------------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>35</td>
<td>Tree</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Vine</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>39</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>40</td>
<td>Tree</td>
<td>1–2 km from village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Tree</td>
<td>Village</td>
<td>Scarce</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>42</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Grass</td>
<td>Village</td>
<td>Scarce</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Grass</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>48</td>
<td>Vine</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Shrub</td>
<td>Village</td>
<td>Scarce</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>50</td>
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<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
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<td>51</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
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<td>52</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>53</td>
<td>Herb</td>
<td>Village</td>
<td>Scarce</td>
<td>Fruit for consumption and gum from resin</td>
</tr>
<tr>
<td>54</td>
<td>Tree</td>
<td>Village</td>
<td>Abundant</td>
<td>Fruit for consumption</td>
</tr>
<tr>
<td>55</td>
<td>Herb</td>
<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>56</td>
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<td>Village</td>
<td>Abundant</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Shrub</td>
<td>Village</td>
<td>Abundant</td>
<td>Flavoring for food</td>
</tr>
</tbody>
</table>

*These numbers correspond with the numbers and plants in Table 4-2.*
Figure 4-1. Herbal remedy knowledge varies among residents of Tabi based on the data free-listing exercise. Several remedies were known by a half to a quarter of the respondents and the vast majority of the remedies were known by only one individual.
Table 4-5. The common remedies from the free-list including the species in the remedy and the illness(es) it is used to treat

<table>
<thead>
<tr>
<th>Species number(s)</th>
<th>Illness(es) treated</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Headache</td>
</tr>
<tr>
<td>2</td>
<td>Stomach air</td>
</tr>
<tr>
<td>3</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>4, 18, 47</td>
<td>Kidney stones</td>
</tr>
<tr>
<td>5</td>
<td>Splinter</td>
</tr>
<tr>
<td>6</td>
<td>Toothache</td>
</tr>
<tr>
<td>7</td>
<td>Hair loss, Dandruff</td>
</tr>
<tr>
<td>8</td>
<td>Vomiting</td>
</tr>
<tr>
<td>9</td>
<td>Infertility</td>
</tr>
<tr>
<td>10</td>
<td>Headache</td>
</tr>
<tr>
<td>11</td>
<td>Diabetes</td>
</tr>
<tr>
<td>12</td>
<td>Bladder infection</td>
</tr>
<tr>
<td>12, 34, 44</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>13</td>
<td>Dysentery</td>
</tr>
<tr>
<td>14</td>
<td>Snake bite</td>
</tr>
<tr>
<td>15</td>
<td>Parasites, Vomiting, Stomachache</td>
</tr>
<tr>
<td>15, 26</td>
<td>Parasites</td>
</tr>
<tr>
<td>16, 53</td>
<td>Evil eye</td>
</tr>
<tr>
<td>17</td>
<td>Bumps on skin</td>
</tr>
<tr>
<td>17, 31, 39, 50</td>
<td>Bumps on skin</td>
</tr>
<tr>
<td>18</td>
<td>No lactation</td>
</tr>
<tr>
<td>19</td>
<td>Warts</td>
</tr>
<tr>
<td>20</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>21</td>
<td>Canker sores</td>
</tr>
<tr>
<td>22</td>
<td>Canker sores</td>
</tr>
<tr>
<td>23, 49</td>
<td>Fever</td>
</tr>
<tr>
<td>24, 43, 53</td>
<td>Evil eye</td>
</tr>
<tr>
<td>25</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>26</td>
<td>Parasites</td>
</tr>
<tr>
<td>27</td>
<td>Eye pain</td>
</tr>
<tr>
<td>28</td>
<td>Dysentery, Diarrhea, Gastritis</td>
</tr>
<tr>
<td>29</td>
<td>Earache</td>
</tr>
<tr>
<td>30</td>
<td>Cough</td>
</tr>
<tr>
<td>32</td>
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<tr>
<td>33</td>
<td>Asthma</td>
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Table 4-5. Continued

<table>
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<th>Plant number(s)</th>
<th>Illness(es) treated</th>
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</thead>
<tbody>
<tr>
<td>36</td>
<td>Dysentery</td>
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<tr>
<td>37</td>
<td>Toothache</td>
</tr>
<tr>
<td>38</td>
<td>Canker sores, Diarrhea</td>
</tr>
<tr>
<td>40</td>
<td>Cough</td>
</tr>
<tr>
<td>41</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>42</td>
<td>Toothache</td>
</tr>
<tr>
<td>45</td>
<td>Stomachache, Stomach fever</td>
</tr>
<tr>
<td>46</td>
<td>Cough</td>
</tr>
<tr>
<td>48</td>
<td>Diarrhea</td>
</tr>
<tr>
<td></td>
<td>Chill in the blood, Chill in the stomach, Diabetes, Stomach air, Colic,</td>
</tr>
<tr>
<td>51</td>
<td>No lactation</td>
</tr>
<tr>
<td>52</td>
<td>Cough, Dysentery</td>
</tr>
<tr>
<td>53</td>
<td>Evil eye</td>
</tr>
<tr>
<td>54</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>55</td>
<td>Burns</td>
</tr>
<tr>
<td>56</td>
<td>Headache, Colic</td>
</tr>
<tr>
<td>57</td>
<td>Earache</td>
</tr>
</tbody>
</table>

Figure 4-2. Knowledge about plant names that are used in common remedies varies among residents of Tabi based on the data free-listing exercise. Over three-quarters (82.5%) of the respondents knew a few plants used to treat illnesses and the vast majority of the medicinal plants were known by only one individual.
Figure 4-3. The competence scores show that the agreement in common herbal remedies varies considerably from 0.95 to 0.10. The maximum competence score is 1 and the minimum is 0. A competence score means that an individual is in perfect agreement with other community members about which herbal remedies are used to treat illnesses. A competence score of 0 means that an individual does not agree at all with the other members of their culture regarding the herbal remedies used to treat illnesses.
CHAPTER 5
EXPLAINING VARIATION IN HERBAL REMEDY KNOWLEDGE


Social networks are the structure through which herbal knowledge is transmitted. In the past decade, researchers have started to use network concepts to understand patterns in natural resource use, knowledge, and management (Atran et al. 2002, Bodin, Crona, and Ernstson 2006, Crona and Bodin 2006, Isaac et al. 2007, Newman and Dale 2005, Tompkins and Adger 2004). Nevertheless, only a few studies have mentioned the potential influence of network structure and
relational variables on herbal knowledge transmission and distribution (Casagrande 2002, Vandebroek et al. 2004), and only one linked relational variables to individual medicinal plant knowledge variation (Reyes-Garcia et al. 2008b). Accordingly, the focus of this chapter was to address the question: to what extent does individual network position explain variation in herbal knowledge across households in a Yucatec Maya community in Mexico, independent of attribute characteristics of the individual? In addition, the following two hypotheses were tested:

- H2: Relative levels of herbal knowledge (cultural competence scores) are positively associated with the individual’s position (in-degree, in-closeness, and betweenness scores) within the medicinal plant remedy knowledge inquiry network.

- H3: The proportion of ties in an individual’s medicinal plant remedy knowledge inquiry network that are with people outside of the community are negatively associated with their relative level of herbal knowledge (cultural competence score).

Before beginning, it is important to note the following. First, the individual cultural competence scores represent levels of agreement of medicinal plant remedy knowledge with the other participants in the study. Agreement is a proxy for cultural knowledge under the conditions of this study and is frequently referred to as knowledge throughout this chapter. The herbal remedies were generally composed of plants that were common throughout the village and often used to treat more than one illness. The illnesses treated were usually common and perceived as non-life-threatening. Next I tried to limit the use of information from ethnobotanical domains other than medicinal plants because attributes that influence ethnobotanical knowledge do not always influence it in the same way within different domains (Phillips and Gentry 1993a). Nevertheless, for some variables it was necessary to incorporate information from studies in other domains of ethnobotanical knowledge because of the paucity of medical ethnobotanical studies. Lastly, another difficulty in making comparisons between studies is that researchers use

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1 Hypothesis one was addressed in Chapter 4.
a variety of methods to measure individual variation in ethnobotanical knowledge (Reyes-Garcia et al. 2007). This methodological variation influences the patterns of variation that are reported in each study so care was taken not to overemphasize the relationship between past and current findings, especially when different measures of knowledge were used.

**Literature Review**

This section is divided into subsections for each variable that was tested in this study for its influence on individual medicinal plant remedy knowledge. The attribute variable subsections appear in the following order: gender, age, livelihood, formal education, range and migration, religion, relative economic prosperity, lifestyle, and individual motivations and talents. In addition, at the end of this section there is a subsection dedicated to relational variables. The subsections in the results and discussion sections also appear in the same order.

**Gender Roles and Their Influence on Medicinal Plant Knowledge**

Gender is a variable that is often, although not always, reported as influencing knowledge acquisition. The most prevalent reason given by researchers for the influence of gender on knowledge is the social role model, which is based on the idea that individuals acquire knowledge through experience (Browner 1991, Nolan and Robbins 1999, Trotter II 1991). Some researchers argue that since women are generally responsible for the health and well-being of their children, they tend to have more knowledge about medicinal plants. Many studies on medicinal plant knowledge distribution used this model to explain greater medicinal plant knowledge among women than men (Arias Toledo, Colantonio, and Galetto 2007, Camou-Guerrero et al. 2008, Caniago and Siebert 1998, Pilgrim, Smith, and Pretty 2007, Quinlan and Quinlan 2007, Voeks 2007). Gendered divisions of space is another model that is sometimes used to explain differences in knowledge between men and women. For example, in some subsistence farming communities, women are responsible for activities such as working in the
home garden and small animal husbandry, which occur within the village, whereas men are responsible for crop production and hunting, which occur in ecological environments in various stages of succession. The environments women frequent are most favorable habitats for medicinal plant procurement because the plants are salient, easy to locate, and easy to collect (Voeks 2007), and these environments may provide a higher number of bioactive medicinal plants (Stepp and Moerman 2001). Thus the increased amount of time spent by women in highly anthropogenic environments may help explain why they tend to have higher amounts of medicinal plant knowledge (Caniago and Siebert 1998, Voeks 2007). Another model, the interaction model, has been used to explain gender-based intra-cultural variation. The model states that increased interactions will lead to similar knowledge (Browner 1991). Browner used this model to explain why male Chinantec speakers from Oaxaca had more idiosyncratic knowledge than females. She found that male knowledge acquisition occurred more frequently with people outside of the community whereas women’s acquisition occurred more frequently within the community. The women shared more knowledge than the men because they had more frequent opportunities to learn the same information from the same individuals.

There are, conversely, several studies that have found no gendered difference in medicinal plant knowledge. Some researchers found that in cases where people from both genders have a vested interest in knowing herbal therapies, the results may be similar patterns of knowledge between men and women. For example, men were denied some access to traditional health care knowledge about reproductive issues in an Oaxacan village, but they were still fairly knowledgeable because they sought the information from sources outside the village (Browner 1991). Another explanation for similar levels of knowledge between men and women is the type of ethnobotanical knowledge gathered. Researchers focused on common knowledge were less
likely to see gendered differences in the data than those focusing on more specialized knowledge (Arias Toledo, Colantonio, and Galetto 2007, Trotter II 1991). The timing of knowledge acquisition may also explain lack of variation. One study performed in rural aboriginal communities in Patagonia, Argentina, found that wild plant knowledge is learned by children through situational learning before there is a large gender difference in labor (Lozada, Ladio, and Weigandt 2006). No gender difference in knowledge was detected, which suggests that if knowledge is learned in places where there is not much division of labor or before children’s tasks are divided by gender, then the knowledge will also not differ by gender. Additionally, several other studies found little or no difference in ethnobotanical knowledge between males and females but failed to explain why (Begossi 2002, Case, Pauli, and Soejarto 2005). So, previous studies show that no clear pattern exists between gender and medicinal plant knowledge.

**Age and Its Association with Knowledge about Herbal Remedies**

In the literature, age is generally positively associated with medicinal plant knowledge (Begossi 2002, Caniago and Siebert 1998). Two processes are often used to describe this association: the process of knowledge accumulation over time and the process of culture change. The general argument for knowledge accumulation over time is that older individuals have had more time to acquire knowledge and experiences related to medicinal plants because they have participated in more illness events than younger individuals (Quinlan and Quinlan 2007, Voeks and Leony 2004). In addition, in some cases elderly individuals are responsible for the bulk of illness treatment because of increased amounts of free time as they age (Voeks and Leony 2004). Estomba and colleagues (2006) found that older people knew more about medicinal uses for native plants than younger people, but there was no difference in knowledge levels about non-native plants. This finding may help support the idea that medicinal plant knowledge increases
over time, although further study is needed to compare the date of introduction of the non-native species and variation in knowledge about the species by age before determining if the evidence is conclusive. Conversely, Stross (1973) and Zarger and Stepp (2004) found that Highland Maya children have adult-level botanical knowledge by the age of 15, suggesting few additional plants are learned in adulthood. Also, Ladio and colleagues (2007) found that most herbal knowledge was acquired in childhood and that there was no relationship between age and medicinal and edible plant knowledge in a rural community in Patagonia, Argentina. Zent and López-Zent (2004) found that there was no relationship between age and relative herbal knowledge in Hoti villages isolated from medical services, but in villages with access to modern medical services there was a relationship.

Other studies reported that more mature individuals tend to be less affected by culture change processes that frequently lead to the reduction in use and knowledge of medicinal plants (Begossi 2002, Estomba, Ladio, and Lozada 2006, Phillips and Gentry 1993a). In many cases older individuals are knowledgeable about herbal treatments because they were critical for survival in the past, whereas younger generations may have more treatment options. Knowledge about medicinal plants diminishes among the younger generations in these cases because there is less practical benefit for acquiring this knowledge (Begossi 2002, Quinlan and Quinlan 2007, Voeks and Leony 2004). In addition, medicinal plant knowledge may be more difficult to acquire than other types of ethnobotanical knowledge, such as edible plants, firewood, or building materials, because of the more complex nature of medicinal plant remedies and the lower frequency of learning events. Therefore even though medicinal plant knowledge acquisition may start at the same time as acquisition of other botanical knowledge, it may take longer and continue later in life, making it more susceptible to culture change processes (Phillips and Gentry
In places where the adaptive advantage of learning herbal remedies is recognized, that type of knowledge is acquired easily in childhood through the same processes as less complex botanical knowledge (Ladio, Lozada, and Weigandt 2007, Zent and López-Zent 2004). The studies in this section suggest that timing of knowledge acquisition and culture change processes may affect the relationship between herbal knowledge levels and age.

Livelihood as a Factor that Influences Medical Ethnobotanical Knowledge

Livelihood is another factor that sometimes plays a role in TEK variation. People who work directly with plants for their livelihood often have more knowledge about them than people who learn about the plants through indirect means such as books (Pilgrim, Smith, and Pretty 2007). Like the social roles argument for variation in knowledge between genders, the underlying assumption here is that people acquire knowledge through direct experience. This argument was used to explain greater agreement in knowledge among people who specialize in herbal curing and non-specialists in a Tarascan community in Mexico (Garro 1986).

Some research shows that the relationship between livelihood and knowledge is not so clear. In Dominica, for example, people with commercial occupations actually knew more about medicinal plants because their positions gave them the opportunity to acquire information from outside of the community (Quinlan and Quinlan 2007). Though Quinlan and Quinlan (2007) found that when people with commercial occupations also had relatively high levels of education, they had less knowledge. This study—along with one on ecoliteracy in the United Kingdom, India, and Indonesia (Pilgrim, Smith, and Pretty 2007) and a research project on children in the Yucatan (Gaskins 2003) —suggests that exposure to the ecological environment as children is important in acquisition of ecological information and retention regardless of adult

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2 Additional research needs to be done on acquisition between different types of ethnobotanical knowledge and with groups that have different rates of acculturation to determine if this is indeed the case.
occupational choices. In households where adults choose to participate in commercial occupations, cultural knowledge loss likely occurs in their offspring because of reduced time allocation to ecologically related tasks (Gaskins 2003). Different domains of ecological knowledge, however, may be affected more severely depending on the specific changes in time allocation that occur. For example, in one Yucatec Maya community, boys no longer learn how to grow maize because their fathers focus on wage labor instead of subsistence farming. Girls, in contrast, continue to learn how to grow garden produce and raise animals because those tasks still occupy their mothers (Gaskins 2003).

**Formal Education and Its Potential to Influence Knowledge**

Formal education reportedly diminishes medicinal plant knowledge because it leads to decreased traditional learning opportunities and often a different way of life with less dependency on the natural environment (Quinlan and Quinlan 2007, Voeks and Leony 2004, Zent 2001). The explanation most frequently given for the negative association between formal education and TEK knowledge levels is that people have a finite amount of time and resources and when individuals attend school they invest some of those resources into formal education, which detracts from their time in locations where accumulation of traditional knowledge tends to occur (Ohmagari and Berkes 1997, Sternberg et al. 2001, Zent 2001). In addition, formal education may provide individuals with more access to commercial jobs, which leads to less direct dependency on nature for material needs and a shift in values, including an intellectual and spiritual disconnect from the natural environment (Ohmagari and Berkes 1997, Voeks and Leony 2004). Individuals with higher education also tend to seek scientific health care and pay for treatment rather than invest time and energy in learning and utilizing medicinal plants.

Education does not always influence TEK (Prince et al. 2001, Reyes-Garcia et al. 2008a, Zarger 2002b). One reason being that in rural areas of developing countries there are often not
many benefits to formal education and therefore individuals invest more time and energy in learning specific skills that will make them successful in their environment (Sternberg et al. 2001). There is a tendency for children in these circumstances to put little energy into learning the material presented in school, frequently miss school, and drop out at a young age (Sternberg et al. 2001). These children place the bulk of their effort into participation in subsistence activities during which they learn the skills and knowledge necessary to be successful adults in their community (Gaskins 1999, Gaskins 2003, Zarger 2002b). Also, as long as herbal remedies remain useful, people will likely continue to learn about them regardless of attending school (Quinlan and Quinlan 2007).

**Traveling and Its Relationship to Medicinal Plant Knowledge**

Other variables identified as influencing medicinal plant knowledge are the geographical range of an individual or the distances they have traveled and amount of time they spent living in communities other than Tabi (Voeks and Leony 2004). The idea is that as people travel and/or live in other communities, their informational networks become more geographically widespread. They are exposed to different cultural practices used to treat illness through the people whom become part of their network, which may result in greater variation in their herbal knowledge as compared to people who have spent most of their lives in one community (Casagrande 2002). In highland Tzeltal communities in Mexico, for example, Casagrande (2002) found that men’s herbal knowledge was more heterogeneous than women’s because they spent much greater amounts of time outside of the community. Browner (1991) also attributed greater idiosyncratic medicinal plant knowledge among Chinantec-speaking men to their tendency to acquire the knowledge while traveling. In addition, Quinlan and Quinlan (2007) found that people from Bwa Mawego, Dominica with wage labor jobs had increased amounts of medicinal plant knowledge because they learned new remedies as they traveled. Although there was some
continuity in herbal knowledge between Dominicans in New York City and the Dominican Republic, herbal remedies to treat diabetes and cholesterol were added to the New York City Dominicans’ repertoire whereas they were not common in the Dominican Republic (Vandebroek et al. 2007). Thus local prevalence of health conditions appears to influence the remedies known (Osoki, Balick, and Daly 2007). An overall reduction in general knowledge is another possible result of increased mobility. Osoki and colleagues (2007) found that Dominicans who had migrated to New York City had less general medicinal plant knowledge than those who resided in rural areas of the Dominican Republic. They reported greater access to scientific health care, education, and social pressures as playing a role in the reduction in knowledge.

Increased travel experiences results in more heterogeneous knowledge or a decline in TEK, whereas increased length of time in a community can increase homogeneity in knowledge because individuals have repeated opportunities to learn from the same people. In addition, individuals who are newer to the community are not as familiar with the flora and how to use it to treat illnesses as people who have lived in the community for their entire lives. Voeks and Leony (2004) found in Lençóis, Brazil, that the longer someone lived in the community, the more likely they were to know the name and use of the medicinal plants in the sample. Overall Voeks and Leony (2004) did not find much of an association between medicinal plant knowledge and range of travel, perhaps because of lack of variability between individuals’ experiences within the community. Longer-term continuous residence in a location can also lead to increased knowledge acquisition, as is the case with the Hoti, who have lived for a long time in one place (Zent and López-Zent 2004).

Religion and Its Affect on Medicinal Plant Knowledge Variation

Religion is an important factor in health and illness because it provides a framework for understanding the causes, preventative measures, and treatment options (Bhasin 2008). It has the
potential to either expand or reduce the use and transmission of medicinal plant knowledge depending on the clergy’s understanding of the role of medicinal plants in health care. The potential impact of religion on medicinal plant knowledge is especially high in places where proselytizing is occurring and new religious beliefs are replacing or mixing with old ones. In Nanga Juoi, Indonesia, Caniago and Siebert (1998) found that Protestant clergy believed that medicinal plant use was a form of traditional magic and consequently discouraged its use, but the researchers found that only one villager reported altering his behavior because of the clergy’s suggestions. Still, the potential of the clergy to affect younger generations is there. Voeks and Leony (2004) also recognized the potential for religions to affect knowledge transmission in Lençois, Brazil, but found that none of the local religious groups advised against using medicinal plants.

**Associating Relative Economic Prosperity and Herbal Remedy Knowledge**

An increase in wealth is occasionally correlated with a decline in TEK (Benz et al. 2000, Pilgrim et al. 2008). The general argument is that as people become more economically prosperous, they lose their spiritual connection with nature and the natural environment no longer becomes the direct source for the majority of their material needs, including food, building materials, energy, and health care (Gaskins 2003, Voeks and Leony 2004). In the case of health care specifically, individuals with access to cash tend to prefer to use pharmaceuticals instead of medicinal plants. The reasons for their preference of pharmaceuticals are their reputation of working faster and be more effective at treating certain illnesses, the potential that the act of purchasing pharmaceuticals may help increase their status, and because of a reduction in time to learn about medicinal plants because they are dedicating much of their time to earning money. Pilgrim and colleagues (2007) found that ecoliteracy, including knowledge about medicinal plants, was negatively correlated to wealth in resource-dependent communities in
India and Indonesia. In contrast, Voeks and Leony (2004) found that relative economic
prosperity had no relationship to medicinal plant knowledge in Lençóis, Brazil. One reason for
this lack of relationship could be that ecotourism, an occupation that values the acquisition of
TEK, is the main method for acquiring wealth in Lençóis.

**Impact of Lifestyle Changes on Medicinal Plant Remedy Knowledge**

The adoption of beliefs and behaviors from other culture groups is frequently reported in
studies to influence intra-cultural knowledge variation. In almost all cases, culture change has
been reported to lead to a decline in medicinal plant knowledge (Caniago and Siebert 1998,
Some of the processes that foster lifestyle changes3 are exposure to formal education, mastery of
the national language, changes in settlement patterns, economic integration, and exposure to
different values (Browner 1991, Caniago and Siebert 1998, Zent 2001). Although a decline in
traditional peasant lifestyle was measured in many different ways, almost all researchers report
that it has lead to increased reliance on scientific medicine and pharmaceuticals and a decrease in
use and knowledge about traditional forms of health care such as medicinal plant use (Case,

The relationship between lifestyle and medicinal plant knowledge, however, may not be as
clear as it seems. In a few studies there was no negative relationship between a reduction in
traditional peasant lifestyle and medicinal plant knowledge levels. Browner (1991), for example,
reported no relationship between the herbal and empirical knowledge of medicinal for

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3 *Acculturation* is used in many studies to refer to what I am calling *lifestyle changes*. I am choosing not to use the
term *acculturation* because the Maya in this region have had contact with the dominant Spanish and/or Ladino
culture to a varying degree since the conquest. The erratic contact and influence between the two groups make it
difficult to measure acculturation. However, before roads and electricity were installed in Tabi in the 1980s, contact
was much less frequent than it is today. Thus lifestyle changes are occurring as a result of an increase in and more
constant contact with the Ladino culture.
reproductive health of women from San Francisco, Oaxaca and acculturation variables such as bilingualism, level of formal education, and travel outside of the community. In addition, she found a positive relationship between Franciscano men’s herbal and empirical knowledge and the three variables she used to measure acculturation. Case and colleagues (2005) found the opposite on Manus Island, Papua New Guinea; there people chose to use pharmaceuticals instead of local medicinal plants even though there is limited access to the former. In places like Manus, the factor of prestige associated with scientific medical practices and pharmaceuticals may be playing a role in loss of medicinal plant knowledge (Voeks and Leony 2004).

**Association between Interest in Medicinal Plants and Knowledge about Herbal Remedies**

One aspect of variation in medicinal plant knowledge that has not been given much attention in the literature is individual differences in interests, talents, motivations, and life experiences. In other words, some individuals know more about medicinal plants than others because of a greater desire to learn about them. Trotter and Logan (1986) mention that different life experiences influence the amount of herbal knowledge individuals acquire. Quinlan and Quinlan (2007) also observed that individuals who listed large numbers of remedies possessed certain characteristics such as a meticulous nature and a love for gardening. Krupnik and Vakhtin (1997) found that expert ecological knowledge among the Siberian Yupik was largely a matter of personal drive and interest in their traditions. Gaskins (2000) showed that Maya children have much free time where they are able to develop interests such as an affinity for curing with herbal remedies. In addition, Browner (1991) found that Franciscano men had a great interest in learning about herbal remedies for women’s reproductive health. The women in their community were unwilling to share the information with them, so they sought out contact with people from other ethnicities in different communities, which allowed them to expand their pharmacopeia.
The general conclusion from this literature review is there are few clear patterns regarding the relationship between individual herbal knowledge and personal attributes. Many of the relationships are a result of local conditions under which herbal knowledge is learned and transmitted. More studies need to be performed to determine the conditions under which patterns do emerge.

**Herbal Remedy Knowledge Distribution and Relational Variables**

Empirical tests of theories and methods of social networks lead to a series of findings relating knowledge distribution among people to their different positions within a social network. Researchers report that strong, close connections (high density) between group members promote free exchange of information (Haythornthwaite 1996). Information in these types of groups tends to be trusted and thus adopted (Coleman, Katz, and Menzel 1966) because the members of the group already share large amounts of knowledge, making it easier to incorporate new knowledge (Carley 1986). In contrast, information obtained through weak ties is less likely to be adopted (Granovetter 1973) because individuals who are not tightly connected have less shared knowledge and concepts, which leads to a reduced ability of the person receiving information to relate it to something they already know and then internalize it (Carley 1986). In addition, although members of high-density groups tend to have extensive access to information from other members of the same group, they have limited access to information from outside of the group (Haythornthwaite 1996). Thus density of relationships in a network is one measure that can influence the flow of information between people.

Another way to determine the ability of information to flow is by identifying groups, referred to as subgraphs, within a network. Recall that networks are represented using graphs,

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4 See Carley’s 1986 article for more information on immediate comprehension, which is what I am referring to here.
which consist of a set of nodes (study participants) and ties among the nodes (links or relationships between the participants). Subgraphs consist of a subset of nodes from the whole graph and their corresponding ties. The simplest subgraphs are components, which are groups within a network where there is an information-exchange path between all individuals (tie) (Borgatti, Everett, and Freeman 2002, Wasserman and Faust 1994). Bicomponents are subgraphs within the network that require the removal of two nodes (participants) to disconnect it. Cut-points are nodes that link overlapping bicomponents, thus people in that position bridge one one group of people (subgraph) to another. The people who hold cut-point positions are in priority positions because they have access to the information available in several groups. In addition, they have the ability to help or hinder knowledge transmission between the different groups. Still, the potential benefit of this position is dependent on the density of the subgraphs. When subgraphs are dense, the people in cut-point positions are at a greater advantage because they are directly linked to more individuals. There are also individuals in isolate positions who are not connected to anyone in the network (Haythornthwaite 1996). Their isolation prevents them from having access to any information within the network. It is important to note that most individuals are part of many different networks and therefore someone who is an isolate in one network may be a central figure in another.

Bicomponent analysis allows researchers to test (at an aggregate level) the suspected advantages and disadvantages of knowledge acquisition in these different positions in the particular network they are studying. Centrality measures allow the researcher to determine (at an individual level) the relationship between knowledge and position. Individuals in prominent or prestigious positions within the network (high scores for degree, closeness, and/or betweenness centrality) may have the ability to control the flow of information through the
creation, maintenance, or prevention of pathways for the exchange of information
(Haythornthwaite 1996).

Therefore individuals in different positions within the network have varying abilities to
influence knowledge flow through the network (Hanneman and Riddle 2005). An individual with
high degree centrality can exert more control over the flow of information than an individual
with low degree centrality because of their direct connection to more individuals. In addition,
people with high degree centrality are less dependent on particular individuals for information
and are able to make more choices because they have more information. Individuals with high
closeness centrality scores are relatively close to other individuals within the network. Thus
when they exchange information it travels through fewer people before it reaches the intended
recipient. In addition, they receive information from a larger number of people and are able to
disseminate their knowledge to a wider group of people than someone with a low closeness
centrality score. Individuals who are positioned between many subgroups play the role of
information broker (Haythornthwaite 1996). The higher an individual’s betweenness score, the
greater their ability to promote or thwart contact and transmit or withhold information between
individuals in subgroups (Hanneman and Riddle 2005). In addition, they may choose to require
payment for their brokering services. In some networks there may be a broker position available
that has not yet been filled; such potential positions are called structural holes (Burt 1992).

In addition, researchers report that greater inequality in structural positions allows people
in prominent positions more control over the flow of information (Hanneman and Riddle 2005).
The amount of inequality in structural positions can be determined by calculating the range of
the mean of the centrality measures and the centralization scores. The greater the range and the
higher the centralization values, the more inequality there is in the centrality scores between
individuals and the greater the ability individuals with high centrality scores have to control the flow of information in the network (Wasserman and Faust 1994).

The last portion of this study tested the assumption that a reasonable boundary for the medicinal plant whole network was the community border. Personal networks are an excellent way to determine the reach of a network, and this type of study is especially useful when the boundary of the whole network is not clearly defined (Wellman 1999). Little research has directly assessed the transmission of medicinal plant knowledge between members of different communities. There is some evidence that it occurs, although less so than knowledge transmission within a community. For example, among the Tsimane’ of Bolivia there was quite a bit of similarity in ethnobotanical knowledge between communities (62%), yet people in the same village shared 20% more knowledge than people between villages (Reyes-Garcia et al. 2003).

Medicinal plant knowledge is socially transmitted, especially among non-specialists (Casagrande 2002), and there are regions, such as the Ozarks (Nolan 1998) and the Highlands of Chiapas (Berlin and Berlin 1996), where extensive sharing of pharmacopeias occurs region-wide. Thus we can assume that transmission events occurred at some point between communities within a region and continue to occur through trade networks, migration, out-marriage, random encounters, etc. There are many examples of this type of sharing occurring in the past, especially when two groups of people establish a new relationship, such as was the case during the time of the Spanish Conquest of Latin America (Voeks 2004) and during African slavery in the Americas (Voeks 1993). Other scant research on contemporary knowledge transmission suggests that the transmission structures, the amount of intercommunity transmission, and the amount of time the transmissions take vary depending on how long communities have been established in a
region and the rate of migration. For example, in long-established Tzeltal Maya communities in the Chiapas Highlands, transmission tended to be between parents and offspring, whereas Tzeltal Maya who recently migrated to a lowland community tended to learn about medicinal plants from family members, friends, neighbors, and acquaintances from inside and outside of the community (Casagrande 2002). People in newly established communities have a much more open system of learning about medicinal plants and are learning new medicinal plant remedies at a much faster rate than the people in the well-established highland communities. This flourish of learning is a result of moving to a new environment and the need to identify plants for use in remedies to cure their ailing family. Atran and co-authors (2002) also provide an example of active intercommunity learning among immigrants in the Peten in Guatemala. They found that new Ladino immigrants who established connections with long-time Maya Itza residents were able to acquire more and better adapted local forest expertise than Q’eqchi’ Maya immigrants who did not seek out Itza advice. Migration is not the only factor that results in knowledge transmission between communities; McMillen (2008) found that in Tanga, Tanzania, market forces, a struggle to improve local livelihoods, and the growing demand for medicinal plants resulted in medical ethnobotanical knowledge transfer at a regional level. Restricted access to information within the community could also lead individuals to look for information elsewhere (Browner 1991).

Results

This section focuses exclusively on the data gathered using structured questionnaires and analyses of that data. Ethnographic data are included in the discussion section to describe more completely the patterns found in the quantitative data. Descriptive statistics and statistical tests of the relationship between each variable and the competence scores that were used to measure relative individual medicinal plant knowledge in Tabi are reported. The statistical tests used were
Pearson’s correlation for continuous variables (Table 5-1) and t-tests and ANOVAs for categorical variables (Table 5-2). These were used to test the two hypotheses (cf. page 165).

**No Relationship between Gender and Differences in Herbal Remedy Knowledge**

The percentage of males and females who participated in this study was almost equal: 45.7% males and 54.3% females. There was no difference in mean competence score between males (0.61) and females (0.65) ($t=1.18$, $p=0.24$, $N=116$).

**Positive Association between Age and Medicinal Plant Knowledge Variation**

The ages of the participants ranged from 16 to 87 and the mean age was 46.4 (SD=17.2). There was a positive correlation between age and cultural competence scores ($r=0.45$, $p<0.01$, $N=116$).

**Limited Variation in Livelihood Strategies**

Practically all men and women in Tabi continue to participate in traditional livelihood activities and spend a larger part of their day outdoors. All adult women in Tabi were homemakers who cared for the plants and animals that were on the household yard. Sixteen men and no women out of 116 worked outside of Tabi in the sixth months before the study commenced. Two of the men were wage laborers on a farm, and the other 14 worked at non-nature-related jobs, such as a block layer or mechanic. All but two of these jobs were temporary, which allowed the men to continue to maintain their maize fields. Only six men did not farm their own maize fields at the time of the study, three of whom were elderly or disabled and had farmed until they were physically unable, two had permanent jobs in Merida and only came back to Tabi on the weekends, but when they were home they sometimes helped family members farm. The other individual was a newcomer to Tabi and did not have rights to farm ejido lands, but often worked in his father-in-law’s field. After gathering and analyzing the data on
occupation, I determined there was not enough variation in livelihood to make it a variable of interest in this study (Bernard 2002:525).

**Negative Relationship between Formal Education and Medical Ethnobotanical Knowledge**

I measured formal education as the number of grades completed and as Spanish literacy. The grades completed by participants ranged from none to ninth grade. The percentage of participants who had not completed any grades was 15%. Of those who attended school, 46.6% had dropped out after completing third grade; the high percentage of dropouts was likely because they had learned basic math and reading skills by then and their parents decided it was more important they participate in household subsistence and the learning of life skills than go to school. Another 31.1% dropped out after finishing their primary school education\(^5\). A mere 7% of participants continued with school, of those people only 3.4% completed middle school. None of the participants went to high school or college (Figure 5-1). Almost 70% of the participants reported themselves to be literate, but most were literate only at a very rudimentary level.

There was a negative relationship between number of grade levels completed and medicinal plant competence scores ($r=-0.29$, $p<0.01$, $N=116$). In addition, the mean competence scores between people who were literate and illiterate were different ($t=2.01$, $p=0.056$). On average, illiterate people had a 0.08 higher competence score than those who were literate. So both forms of data used to measure formal education, grades completed and literacy, showed that formal education is negatively associated with medicinal plant remedy knowledge.

**Varied Association between Experiences Traveling and Herbal Remedy Knowledge**

The majority (88.8%) of adults living in Tabi during 2007 were from Tabi. A small percentage (7.7%) of participants were living in communities and ranches near Tabi at the time.

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\(^5\) Sixth grade is the last grade in primary school.

\(^6\) The p-value was 0.046 before rounding.
of their birth, the remainder lived in towns in the region, the farthest being Merida, only 64.1 km away. In addition, the majority (81%) of individuals never lived anywhere but Tabi (Table 5-3). Of the people who lived elsewhere, most lived in regional centers such as Merida (5.2%) and Cancun\(^7\) (7.8%), the remaining few (6%) lived in small towns and cities within the Yucatan Peninsula. The majority of participants had traveled to at least regional centers with only one individual having never left Tabi. The farthest from Tabi that most people had been was Merida (40.5%); another large number of people had traveled as far away as Cancun (27.6%). A little over a tenth of the population traveled off the peninsula; the majority to Mexico City (5%). One person traveled to the United States and another to Canada, both as guest farm workers for short periods of time.

The relationship between number of years living in Tabi and competence scores was positive \((r=0.43, p<0.01, N=116)\). It is also highly correlated with age \((r=0.94, p<0.01, N=116)\). In contrast distance from Tabi at time of birth, farthest distance lived, and farthest distance traveled were not related to individual competence scores \((r=0.02 \ p=0.81, \ r=0.12 \ p=0.18, \ r=-0.07 \ p=0.44, \text{ respectively, } N=116)\).

**No Difference in Herbal Remedy Knowledge between Religions**

Religious affiliation in Tabi was more diverse than one might expect from a rural community in historically Catholic-dominated Mexico. Indeed, many people self identified as Catholic (45.7%), but a small and reportedly growing portion of community members identified themselves as Jehovah’s Witnesses (14.7%). Some other Protestant missionaries had successfully converted small numbers of residents to their religions, including Pentecostal (6.0%), Baptist (3.4%), Evangelical (2.6%), Prophecy of Christ (2.6%), Presbyterian (0.9%), Cavalry Chapel of

\(^7\) Cancun is 166 km from Tabi.
Tabi (0.9%), Church of Christ (0.9%), and the Christian Church (0.9%). In addition, one woman self identified as both Catholic and Jehovah’s Witness reportedly to avoid conflict. The remaining 20.7% of the participants claimed no religious faith (Figure 5-2).

There was no difference in medicinal plant competence scores between people of different faiths (F=1.38, p=0.20, N=116). To confirm that the lack of significance was not a result of low numbers of Protestants, I placed them together into one group and compared their mean competence scores with those of the Catholics and people with no religious faith. There was still no difference in mean competence scores between the two groups (F=2.29, p=0.11, N=116).

**Relative Economic Prosperity and Medicinal Plant Knowledge Not Associated**

People in Tabi generally are considered poor; their work is labor-intensive and they survive on daily earnings and subsistence agriculture. Yet after spending time in the community, it became apparent that residents differ in their access to monetary, material, and food resources. I learned through informal interviews that there were several things the people of Tabi used to determine the economic prosperity of their fellow community members. I selected five of the indicators—a hammock, television, stereo, refrigerator, and stove—to form a Guttman scale with which I measured relative economic prosperity in the community. The majority of participants fell into the middle range of the five-point relative economic prosperity scale; 31.9% scored a 2, 34.5% scored a 3, and 20.7% scored a 4. A mere 4.3% fell into the highest group of relative economic prosperity, while 8.6% were in the lowest group (Figure 5-3). There was no relationship between relative economic prosperity and competence scores (r=−0.16, p=0.09, N=116).

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8 In Chapter 3 I describe how I selected these items.

9 The lowest level is 1, and 5 is the highest level of relative economic prosperity.
Negative Relationship between Modern Lifestyle and Medical Ethnobotanical Knowledge

Lifestyle is difficult to measure because there is no one question that captures the degree to which an individual is leading a traditional peasant lifestyle. Researchers have selected a wide variety of variables to try and assess lifestyle differences of participants as influenced by exposure to people from different groups. One of the best ways to measure lifestyle is by identifying proxy measures and combining them to form one scale, much like I did to measure relative economic prosperity. Individual fluency in the local language is generally a good proxy, but in Tabi there was not enough variation for it to be useful (Maffi 2005, Posey 2001). Individuals in the community helped me create a list of lifestyle indicators by describing individuals they considered fairly modern and individuals they considered fairly traditional. Ultimately I reduced the lifestyle scale to six items including consumption of leavened bread, occasional or frequent purchasing of machine-made tortillas, preference for speaking Spanish with children, preference for speaking Spanish with other adults, preference for wearing Western clothes, and ownership of a bed. Individual lifestyle scores ranged from 0 to 6 with 0 representing individuals with an extremely traditional peasant lifestyle compared to the other participants and 6 representing individuals who had an extremely modern lifestyle relative to the other informants (Figure 5-4). Few individuals continued to be extremely and very traditional (1.7% scored a 0 and 3.4% scored a 1). Almost three-quarters of the individuals practiced a mix of traditional and modern lifestyles (26.7% scored a 2, 22.4% scored a 3, and 24.1% scored a 4). A little over one-fifth of the participants had very and extremely modern lifestyles (19.8% scored a 5 and 1.7% scored a 6). Lifestyle scores were negatively correlated with competence scores (r=-0.26, p=0.01, N=116).

10 In Chapter 3 I describe how I selected these items.
High Interest in Medicinal Plant Remedy Knowledge

Most examples of measures of individual interests are qualitative because of the difficulty in capturing this attribute in a quantitative manner. It is important, however, to develop quantitative methods to measure interests to support the information gathered using qualitative methods and to make comparison between studies easier. Consequently, I selected four questions related to treatment preference and interest in medicinal plants to help illuminate the relationship between interest and knowledge. I found that 94% of participants had interest in medicinal plants. Over three-quarters of the individuals (88.8%) had used medicinal plants to treat their children and over two-thirds (69%) used medicinal plants more often than any other treatment to cure common illnesses. In addition, there was a general tendency (69.8%) to treat common illnesses at home. There was no difference in mean competence scores between any of the variables used to test individual differences in interest at the 0.05 level. This is probably because of the lack of variation in responses or the way the question was framed. Interest is difficult to assess and more work needs to be done to develop a series of questions to explore variation in interest. Differences in competence scores were detected between the different responses for two questions at the 0.10 level of significance. In one case, the mean competence score of individuals who tended to visit a scientific medical doctor to treat common illnesses was .07 lower than for people who sought treatment at home or with a traditional healer (t=1.77, p=0.08, N=116). In the other case, the average competence score for those who preferred to use medicinal plants to treat common illnesses was higher by 0.073 than those who preferred to use pharmaceuticals (t=1.841, p=0.068, N=116).

Varied Association between Relational Variables and Herbal Remedy Knowledge

The results described in this section are a product of various social network analyses. A few measures of the entire medicinal plant network were performed in UCINET to gain a general
sense of the pathways available for information flow (Figure 5-5). Then an analysis of the relationships between position and competence scores was performed by identifying bicomponents, cut-points, and isolates using UCINET, and an ANOVA was done to determine if there was a relationship between the average competence scores for people in the different positions (Table 5-4). Next, individual position scores such as in-degree, out-degree, in-closeness, out-closeness, and betweenness were calculated using UCINET. Those relational scores were then correlated with individual competence scores using a Pearson’s correlation to determine if there was a relationship between individual position and the level of agreement in medicinal plant remedies individuals had with the other participants from Tabi (Table 5-5).

Lastly, each participant was asked who they asked from other communities about medicinal plants. The proportion of individuals asked from other communities out of the total was calculated.

The medicinal plant network I constructed for Tabi consisted of 96 individuals; the other 18 individuals that participated in this study reported no communication with any of the other participants about medicinal plants. The density of the entire network was 0.018 (SD=0.134). The fragmentation scores, proportion of nodes that can reach each other, and the reciprocity value were 0.29, 0.71, and 0.03, respectively (Table 5-6).

The bicomponent analysis identified which nodes were cut-points and which nodes were members of different bicomponents. There were 26 bicomponents in the network; one consisted of 73 nodes and the others of two nodes each. There were 14 cut-points and the remaining 18 points were isolates. The mean competence scores for individuals in isolate, bicomponent, and cut-point positions were 0.54 (SD=0.21), 0.64 (SD=0.20), and 0.70 (SD=0.16), respectively (Figure 5-6). The mean competence score for the bicomponent that consisted of 73 nodes, and
the bicomponents, which consisted of two nodes each, was the same with only slightly different standard deviations (mean=0.64, SD=0.19 and 0.20, respectively). There was no difference between the mean competence scores for isolate, bicomponent, and cut-point positions (F=3.02, p=0.05, N=116). An LSD post-hoc test was run to more fully understand the relationships between mean competence scores in different positions. The results of that test showed differences in mean competence scores between isolate and bicomponent positions and between cut-point and isolate positions (mean difference=-0.10, p=0.48, N=102 and mean difference=0.16, p=0.02, N=32, respectively). However, there was no difference in mean competence scores when comparing bicomponent and cut-point positions (mean difference=-0.06, p=0.28, N=98).

The individual position analysis found that in-degree and out-degree mean scores were the same (2.11) but their standard deviations were different (SD=3.08 and 5.50, respectively) and their ranges varied as well (0 to 19 and 0 to 37, respectively). The mean in-closeness and out-closeness values were also the same at 3.53 and their standard deviations varied (3.86 and 8.89, respectively). Their ranges differed with 1 being the minimum closeness score for both and 22.42 and 52.75 the maximum scores for in-closeness and out-closeness, respectively. The average betweenness score was 7.49 (SD=33.05). Notably 76.7% of actors had a 0 betweenness score, which means they did not lie along any shortest paths between pairs of actors. In addition, two individuals had relatively high betweenness scores of 252.75 and 224.52 (Table 5-7). The in-degree and out-degree network centralization scores were 14.81% and 30.6%, respectively. In addition, 1.89% was the betweenness network centralization index. Closeness centralization scores cannot be calculated because not all of the nodes in the network are connected (Table 5-6).
In-degree scores were positively correlated with medicinal plant competence scores ($r=0.30$, $p<0.01$, $N=116$) whereas out-degree scores were not correlated ($r=-0.14$, $p=0.14$, $N=116$). The correlation between in-closeness and out-closeness and individual competence scores were $r=0.29$ and $r=-0.15$, respectively; but only the correlation between in-closeness and competence scores was significant ($p<0.01$ and $p=0.11$, respectively, $N=116$). Betweenness scores and competence scores were not correlated ($r=0.01$, $p=.94$, $N=116$).

A large majority of the individuals (87.9%) did not ask anyone outside of Tabi about medicinal plants. Of those that did ask people from other communities about herbal remedies, nine of them (7.8%) asked more people from Tabi and 4.3% asked the same number of people from Tabi as from other places. There was no association between the proportion of people asked from other communities about herbal remedies and the total number of people asked and competence scores ($r=0.08$, $p=0.37$, $N=116$).

In addition to analyzing the influence of each variable separately on competence scores, I ran a multiple regression analysis to determine which variables were most influential when controlling for all other variables and to determine how much of the individual knowledge variation was described by relational variables after controlling for individual attributes. In order to reduce problems of multicollinearity when two variables were highly correlated, only the variable that had the largest influence on competence scores was included in the analysis. Age and number of years living in Tabi were highly correlated ($r=0.94$, $p<0.01$, $N=116$) and in-degree and in-closeness were also highly related ($r=0.95$, $p<0.01$, $N=116$). Therefore in-degree
and age were selected to be used in the multiple regression analysis. The linear regression model is described in the following equation:

\[
E(\text{competence score}) = 0.390 + 0.007(\text{in-degree}) + 0(\text{betweenness}) + 0.005(\text{age}) - 0.008(\text{grades competed}) + 0(\text{distance traveled}) + 0.006(\text{lifestyle score}) - 0.025(\text{relative economic prosperity score}) + 0.062(\text{female}) + 0.053(\text{literate}) + 0(\text{Catholic}) - 0.023(\text{Protestant}) + 0.025(\text{herbal remedy preference}) + \text{error}
\]

The last five variables in the equation—female, literate, Catholic, Protestant, and herbal remedy preference—are categorical dummy variables; the coefficient is multiplied by 1 for individuals that are described by the variable listed and 0 otherwise. The linear correlation between the observed competence scores and the model predicted values was moderate (R=0.53, R²=0.28, N=116). The ANOVA test shows that the variation described by the model is not due to chance (F=3.40, p<0.01, N=116). Age was the only variable that explained any of the variation in competence scores above and beyond what was explained by the other variables (t=3.14, p<0.01, N=116).

**Discussion**

This section focuses on a discussion of the results. Information that was obtained through qualitative methods is also included in areas where it helps elucidate the points being made. The order of the subsections is the same as the previous two sections.

**Individuals of Both Genders Involved in Health Care Decision-Making**

There is no difference in medicinal plant remedy knowledge based on gender in Tabi. One probable reason is the focus of this study on common knowledge. The general nature of common knowledge is that it is more widely shared than specialized knowledge. In addition, common medicinal plant knowledge tends to be fairly consistent because people tend to share remedies that they have used and that were effective (Ankli, Sticher, and Heinrich 1999a, Canales et al. 2005, Johns, Kokwaro, and Kimanani 1990, Trotter and Logan 1986). A study performed in the
Córdoba Province in Argentina found no differences in knowledge of commonly used plants based on sex or age; for more unusual treatments, however, women and older people had more knowledge (Arias Toledo, Colantonio, and Galetto 2007). Therefore the common nature of the remedies that were the focus of this study helps explain the lack of difference in knowledge between men and women in Tabi.

Another probable reason why there is no difference between men and women’s competence scores in this study is that people from both genders are equally familiar with the plants. The plants are extremely common, often have more than one use, and are generally available in public spaces frequented by both men and women. Logan and Dixon (1994) and Voeks (1996) also argued that high visibility, familiarity, and accessibility of commonly used medicinal plants helped explain why there was no difference in knowledge between genders in their studies.

Although most social roles are fairly distinct for men and women in Tabi, the role of primary health caretaker is not defined by gender. After analyzing the data on gender, I had one of my research assistants ask 20 of the original participants to answer some questions regarding medical decision-making. The purpose of the interviews was to better understand who was making health care treatment decisions for the family and to see if there were any gender-related patterns. When asked who in the household decides how to treat an ill family member, the majority (45%) of people responded that they decide together with their partner. The male household head was responsible for deciding in 30% of the households and the female in 25% of the households. When asked who decides what medicinal plant remedies to use once it has been decided that an herbal treatment will be administered, joint decision-making was again the most

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11 The subset was relatively diverse with individuals of varying ages, genders, and levels of medicinal plant knowledge.
common response (35% of the households). Women were responsible in 35% of the households and men in 30%. These findings show that even though women are generally responsible for taking care of the children, there is a tendency for joint decision-making in household affairs including the treatment of family members with herbal remedies. This pattern of joint decision-making shows that men and women both have a need to learn about medicinal plants to effectively treat their children’s illnesses. Patterns of joint decision-making for major household decisions has been observed among other indigenous groups in Mexico as well (Browner 1991, Casagrande 2002).

**Herbal Remedy Knowledge Accumulated by Individuals over Time**

This study, like many others (Begossi 2002, Caniago and Siebert 1998, Estomba, Ladio, and Lozada 2006, Phillips and Gentry 1993a, Quinlan and Quinlan 2007, Voeks and Leony 2004) revealed that medicinal plant knowledge accumulates with age. The positive relationship between age and knowledge may not be due entirely to knowledge accumulation, lifestyle changes of younger community members may have caused a decreased need to learn about medicinal plants. An exploration of the role of acculturation in this finding follows.

During my time in Tabi I conversed with many individuals about their experiences learning about medicinal plants. The majority of them suggested that the bulk of what they know was learned after they had children. I further confirmed that finding by having my research assistant formally ask 20 study participants when they learned the majority of what they know about medicinal plants. Forty percent of the individuals reported that they learned about herbal remedies when they were recently married, another 40% learned after having their children, and
10% said they learned once their children starting getting sick\textsuperscript{12}. The remaining 10% reported that they learned about medicinal plants as children. These findings confirm that the relationship between age and knowledge is at least partially explained by accumulation.

A decreased interest in learning about medicinal plants by younger individuals as a result of changing lifestyle can also contribute to the finding of a positive association with age and knowledge. The importance of changes in lifestyle can be explored by comparing knowledge by age cohorts and determining if the pattern differs and can be associated with an event. I used Zent’s (2001) technique of dividing the data into two age cohorts and ran separate correlations between age and competence scores between the two different groups. I found that there was a positive correlation between age and competence for individuals 45 and younger (r=0.46, p<0.01, N=59) but none for individuals 46 and older (r=0.13, p=0.32, N=57) (Figure 5-7, Figure 5-8). Zent (2001) saw a dramatic decline in knowledge that correlated with the relocation of the Piaroa in Venezuela, and Voeks and Leony (2004) saw a striking difference in knowledge levels between the 61–70 age group and 71–80 age group in Lençois, Brazil. Voeks and Leony (2004) argue that the extreme difference in knowledge is a result in the shift from using traditional medicine as the only illness survival strategy to having multiple options for treated illnesses. The establishment of schools, roads, and a scientific health care clinic during the last 45 years has lead to an intensification of inter-cultural contact, economic integration, and cultural westernization, which may help explain the lower levels of knowledge among younger individuals.

\textsuperscript{12} All of these events usually occur around the same time in Tabi. Marriage and having children frequently coincide and do not occur in any particular order. In addition, children are often plagued with gastrointestinal disorders at a young age presumably because of high exposure to contaminated soil and unclean water.
Changes in lifestyle appear to have affected the timing of knowledge transmission as well. There is some evidence in populations where traditional peasant lifestyles are the norm that the positive correlation between age and medicinal plant knowledge is not as strong or nonexistent (Case, Pauli, and Soejarto 2005, Lozada, Ladio, and Weigandt 2006). In the case of the Hoti of Venezuela, a group with relatively low levels of acculturation, medicinal plant knowledge acquisition starts in early childhood and increases until 18–28 years of age (Zent and López-Zent 2004). These studies provide evidence that in less-acculturated groups the bulk of knowledge is learned in childhood and knowledge accumulation slows or stops in adulthood. In Tabi, almost all of the medicinal plant remedy knowledge is learned in adulthood, suggesting that lifestyle changes are affecting transmission practices. There were only two individuals in the sample who learned the bulk of what they know about medicinal plants as children: a 77-year-old woman (the oldest individual in the sample) and a 59-year-old man.

In addition to normal processes of accumulation of knowledge with age, a change in lifestyle—evident in delayed acquisition and the change in relationship between age and competence scores between people older and younger than 45—does appear to be an underlying factor in the positive correlation between age and medicinal plant competence scores in Tabi.

Livelihoods May Influence Herbal Remedy Knowledge in Future

Although livelihood did not vary enough to be able to correlate it with relative medicinal plant remedy knowledge, the long-term effects of livelihood choices may affect the medicinal plant remedy knowledge in younger generations. An increasing number of teenage boys and girls are leaving the village to participate in wage labor. This trend was not so common before a daily

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13 More research needs to be done comparing knowledge levels between children and adults and knowledge levels and transmission process in communities with different levels of acculturation to better understand the relationship between age, knowledge, and acculturation.
bus route was established between Tabi and Merida around 1998. Wage labor for young women has become especially regular as women often live with a family in the city and carry out domestic chores. If the family and the girl have a good relationship, the young woman may stay with the same family for many years. Most girls work until they marry (around 18 years of age) and then they move back to the village to raise their children. Although some young men find work as temporary, unskilled construction workers, others have more regular jobs in supermarkets and meat processing plants. Men often continue their wage labor jobs after they are married. As a consequence, increased exposure to outside influences of both young men and women may lead to more heterogeneous medicinal plant remedy knowledge within the community (Browner 1991, Quinlan and Quinlan 2007). In addition, if men continue to work outside of the community after they marry, their knowledge acquisition may decrease because they will not participate as much in their children’s illness events, when the bulk of medicinal plant remedy knowledge is currently accumulated in Tabi. Previous studies show that decreased participation in activities leads to decreased acquisition of knowledge specific to those activities (Browner 1991, Gaskins 2003). In addition, if men choose to continue to learn about medicinal plants, their knowledge may become more idiosyncratic because the network they use for acquiring knowledge is not restricted to the community, as reported in some studies (Browner 1991, Quinlan and Quinlan 2007).

**Formal Education and Less Time to Learn about Herbal Remedies**

In Tabi there is a negative relationship between medicinal plant remedy knowledge and years completed in school. In addition, those who are literate have less herbal knowledge than those who are not. Time spent in school is not likely to directly influence adult variation in medicinal plant remedy knowledge because children still spend a large amount of time participating in traditional farming activities (cf. Gaskins 1999 for additional example) and the
majority of medicinal plant remedy knowledge is acquired in adulthood in Tabi. Indirect influences of increased time in school—such as more participation in commercial and more permanent jobs, reduced exposure to learning opportunities such as illness events, and a preference for scientific health care—may play a more pronounced role in decreased acquisition of knowledge. This was supported by the a positive relationship between amount of education and tendency to work outside of Tabi; people who had worked outside of Tabi during the six months preceding the study had an average of 5.06 years of education, 2.16 more years on average than those who had not worked outside of Tabi during the same time period (t=3.34, p<0.01, N=116). Literacy rates were also higher among those who had worked outside of Tabi during the six months preceding the study than those who had not (χ²=5.41, Fischer’s Exact Test p=0.04, N=116).

Individuals with jobs in Merida tend to be away from the village frequently and miss more of their children’s illness events, the main opportunity for learning about medicinal plants. In addition, households where there are members who participate in wage labor have more cash, which makes private practice scientific health care visits and pharmaceuticals more accessible to these individuals. The two participants with permanent jobs showed a preference for scientific medicine in their treatment choices; they both preferred to visit a scientific medical physician to treat their family members, and if they decided to treat the illness at home, they preferred to use pharmaceuticals. Another consequence of increased time in school is that young people tend to marry and start having children later in life, which also delays the acquisition of medicinal plant remedy knowledge. Increasing delay leads to a widening age gap between the knowledgeable elderly informal teachers and the knowledge-seeking young adults, making transmission more difficult because there is more likelihood that the knowledgeable adults will die before
transmitting the knowledge, differences in language preference become more pronounced, and learning styles may diverge (cf. Ohmagari and Berkes 1997 for more information).

Although there is a relationship between medicinal plants remedy knowledge and number of years of school attended, the relationship is rather weak. This weak relationship is likely because of the relatively small range in number of years of school attendance; the mean number of years of attendance was 3 with a standard deviation of 3. In addition, although there is a small contingency of parents who believe that education is a means to improve the economic situation of the family. Also, there are two strong factors that deter parents from sending their children to middle school. The first is that middle school has a reputation as a place where students acquire a lack of respect for their elders and a rebellious nature. It is also believed to be a place for girls to get boyfriends, which is undesirable for parents because teen pregnancy out of wedlock is extremely common but socially unaccepted in Tabi. In addition, there is a weak relationship between formal education variables and employment outside of Tabi, likely because the majority of jobs acquired are low skilled, low paying, and temporary; these types of jobs do not tend to lead to greater long-term economic security. Therefore families are not able to become too dependent on scientific medicine and, in general, medicinal plants continue to be an important form of health care, especially during times of economic insecurity.

**Limited Experiences Traveling and Living Outside of Tabi**

The lack of a relationship between variables measuring geographical range of individuals and medicinal plant remedy knowledge is likely the result of a dearth of variation in experiences of community members traveling and living outside of Tabi. The majority of participants were born in Tabi and have lived there all their lives. In addition, although some have traveled quite

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14 The prevalent belief in the village still remains that school is a waste of time because it takes away from the time children can learn farming and domestic skills, especially after students learn to read and write in primary school.
far from the community, the majority of those trips were of short duration during which they were unable to establish the networks necessary to obtain trustworthy information about medicinal plants. The issue of gendered differences in travel has been used to explain variation in knowledge between women in men among the Franciscanos in Oaxaca (Browner 1991) and the Tzeltal Maya in Chiapas (Casagrande 2002), but, in Tabi there is little distinction between frequency of travel between men and women, especially for the younger generations. Both young men and women have worked for extended periods of time in regional centers. This experience provides them both opportunities to learn about medicinal plants from outside of the community. It also helps explain why there is no difference in knowledge variation between males and females.

**Religions Not Prohibitive of Herbal Remedy Use**

All religions practiced in Tabi permit the use of medicinal plants to cure illnesses. The Jehovah’s Witnesses are prohibited from using medicinal plants to cure illnesses of supernatural origin, like evil eye, because the religion denies the existence of non-natural illnesses. Regardless, there was no difference in mean competence scores between individuals from different religions. This lack of difference is probably because most Jehovah’s Witnesses in Tabi converted to that religion within the last 10 years; thus they still know many of the plants used to treat supernatural illnesses. The next generation of Jehovah’s Witnesses will not likely be taught the cures for supernatural illnesses; consequently, their herbal knowledge may differ from the Catholics who continue to learn about treatments for supernatural illnesses.

Individuals with no religious affiliation had lower competence scores than all other participants. The competence scores of people without a religious affiliation may be lower because they tend to be younger and, therefore, have not had as long to acquire medicinal plant remedy knowledge as the Protestants and Catholics. Initially I thought that a proclivity toward
modern practices, such as the use of scientific medicine, may have contributed to their low scores, but Protestants scored highest on the lifestyle and relative socioeconomic scales, which suggests they are more likely to use scientific medicine and they have the socioeconomic means to pursue it, not the people with no religious affiliation.

**Limited Access to Stable, Wage-Earning Employment**

It is highly probable that relative economic prosperity and medicinal plant remedy knowledge are not associated because all families in Tabi are still directly reliant on nature. Even the most well-off families are still dependent on their *milpa* for the majority of their food, the forest for their cooking fuel and some of their building materials, and medicinal plants when they are low on cash and are unable to buy pharmaceuticals. The amount of money earned by people in Tabi often varies from week to week, making it an unreliable source for the acquisition of food and other necessities. In addition, the concept of saving money is apparently foreign to most community members; therefore those people who are able to earn a little extra money usually spend it on luxury items instead of saving it for future times of need.

The negative relationship between medicinal plants remedy knowledge and relative economic prosperity may become stronger if external sources of income become more available and people start using medicinal plants only during times of economic hardship instead of as a primary treatment option\(^{15}\). Elsewhere it was shown as long as resources remain useful, people will acquire knowledge about them (Gaskins 2003, Pilgrim, Smith, and Pretty 2007). Wealth can decrease natural resource dependence and, as a result, spur a decline in knowledge acquisition about those resources (Pilgrim, Smith, and Pretty 2007).

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\(^{15}\) Most people still used them as a primary treatment option during the time of this study.
**More Modern Lifestyle Associated with Reduction in Traditional Knowledge**

An increase in adoption of a modern lifestyle negatively influenced the amount of medicinal plant remedy knowledge in Tabi as reported elsewhere including Manus Island, Papua New Guinea (Case, Pauli, and Soejarto 2005), Lençóis, Brazil (Voeks and Leony 2004), Kalimantan, Indonesia (Caniago and Siebert 1998), Gavilán, Venezuela (Zent 2001), and Rio Grande Valley, Texas (Trotter and Logan 1986). In many of these cases the researchers showed that an increase in modern services and contact with other groups leads to a shift in lifestyle and a growing reliance on scientific medicine (Case, Pauli, and Soejarto 2005, Trotter and Logan 1986, Voeks and Leony 2004, Zent 2001). As the reliance on other types of health care services increases, traditional herbal remedies are utilized less and medicinal plant remedy knowledge becomes less widespread. Since the end of the revolution in the 1920s, the Mexican government has provided modern services to rural communities throughout the Republic. The citizens of Tabi were granted many modern services approximately 20 years ago during the administration of Victor Cervera Pacheco, the governor of the state of Yucatan. The services included electricity, potable water, middle school (through ninth grade), paved roads, and a health care clinic. The availability of these services, increased outmigration to regional centers, and a wider array of health care options likely resulted in a decrease in reliance on medicinal plants to cure illnesses and increased variation in medicinal plant remedy knowledge acquired in Tabi.

**Personal Interest in Medicinal Plants Motivates Learning**

I found no association between interest and medicinal plant remedy knowledge. This may be because my survey instrument was not fine-tuned enough to identify the variation in interest, or it may be because personal interest does not explain much, if any, of the variation. Still, like what was found on the island of Dominica (Quinlan and Quinlan 2007) and among the Siberian Yupik (Krupnik and Vakhtin 1997), there is ethnographic evidence that personal drive and
interest play important roles in medicinal plant knowledge acquisition. The desire to cure a family member with an illness that is difficult to treat or the potential for some additional income as a curer were strong motivators for two individuals in Tabi to seek out information about herbal remedies. In addition, although not studied directly, it is possible that individuals in Tabi identify when they are children if they have an affinity for curing using medicinal plants and choose to use part of their great amount of unsupervised time to seek out learning opportunities and cultivate their interest. This certainly seems to be the case with the grandson of the curer who, at the age of 12, was highly proficient in naming and identifying uses for medicinal plants. This level of proficiency at such a young age is unique in Tabi, where most people learn about medicinal plants once they enter adulthood and need to use them to cure their own children. Gaskins (2000) supports this idea in her study on Yucatec Mayan children in a community on the east side of the state of Yucatan. She found that they use quite a bit of their time to learn tasks through observing adults. Thus evidence from Tabi shows that personal motivation and interest do play roles in knowledge acquisition, although not to the extent that they explain a significant amount of the variation in medicinal plant remedy knowledge.

**Individuals Knowledgeable about Herbal Remedies become Centrally Located**

Like many of the personal attribute variables, some relational variables also influence medicinal plant remedy knowledge. The overall network structure does not foster the flow of medicinal plant remedy knowledge because the density is low, meaning there exist few links between people through which information can flow. The low fragmentation scores demonstrate that the distance between individuals is relatively great, which reduces the chances of successful knowledge transmission between households. Conversely, the proportion of individuals that are linked is relatively high, but most of the connections between individuals are not mutual and instead flow from one individual to another, as indicated by extremely low reciprocity value. The
structure of this medicinal plant network may help explain why there was such a large amount of idiosyncratic medicinal plant remedy knowledge that appeared in the free-listing exercise.

People in cut-point positions have the highest medicinal plant competence scores compared to individuals in isolate or bicomponent positions indicating that they have access to more medicinal plant remedy knowledge and the ability to control more knowledge than those in other positions. The benefits of the cut-point position are similar to findings in previous research (Burt 2004, Granovetter 1973). Yet their ability to obtain information and control the flow of information in this network was limited by structural characteristics, such as the low density of ties (linkages), the large number of one-way ties, and the large number of individuals in one bicomponent. These structural characteristics likely explains why there was no difference in mean competence scores of individuals in cut-point and bicomponent positions. Individuals in isolate positions had lower mean competence scores than individuals in the other two positions. These individuals do not have contact with any other individual in this network and consequently, do not have access to information flowing through the network. In some cases, these individuals may never have been involved in a medicinal plant network. In other cases, their medicinal plant remedy knowledge may just be different from the majority of people who participate in the network. Those individuals may be involved with a medicinal plant network in a different community or they may have learned about medicinal plants from someone in Tabi who has since died. The removal of their link to the network decreases their ability to incorporate any new medicinal plant remedy knowledge acquired by individuals in the Tabi network at the time of the study.

In-degree and in-closeness were positively correlated with competence scores whereas out-degree, out-closeness, and betweenness were not. The correlation of both in-degree and in-
closeness with competence scores is not surprising because they are highly positively correlated \((r=0.95, \ p<0.01, \ N=116)\). Therefore, individuals with many direct ties are also closest to other people within the network. Hence, people in Tabi tended to seek out individuals knowledgeable about herbal remedies when seeking advice, and individuals who were closer to actors who were asked by more people about medicinal plants tended to have higher competence scores.

A few previous studies reported that people in more prestigious positions have more medicinal plant remedy knowledge. Reyes and colleagues (2008b) results showed a positive relationship between prestige of Tsimane’ adult men and ethnomedical plant knowledge in lowland Bolivia. They also found that prestige was associated with having held a position of authority in the village. They argued that their findings did not allow them to conclusively determine the association between prestige, knowledge, and age because of methodological problems. It is important to note that in the Tsimane’ study, prestige was defined by the members of the community instead of using degree from SNA, as was performed in this study. Quinlan and Quinlan (2007) also showed evidence that the individuals knowledgeable about herbal remedies were also sought out by other villagers for all types of advice. In addition, Casagrande (2005) found that medicinal plant knowledge was commodified in migrant communities in the lowlands of Chiapas, which restricted access to that knowledge to individuals with capital and power within the communities.

In Tabi, the three individuals with the highest in-degree scores were well-known healers. These healers did not have the highest medicinal plant competence scores; instead older men and women who were not specialists but were knowledgeable in herbal remedies had the highest scores. This finding is likely because the knowledgeable non-specialists information more closely resembles the general populace, whereas the healers have more specialized knowledge.
that they have honed from years of practicing their trade. In addition, although many participants reported visiting healers for advice on herbal remedies, visits to healers tend to be reserved for rare ailments, whereas friends and family are consulted more often for common illnesses. Thus specialists have fewer opportunities to influence common medicinal plant remedy knowledge than non-specialists. These findings are similar to those of Boster and colleagues (1987) in their study of a university administration office. They found that individuals who interacted frequently with other individuals did not have the highest individual competence scores. Instead they found that individuals who were not central but slightly peripheral had the optimal amount of information about the office members in that their responses were more similar to the modal responses of the office members. Central individuals had access to greater information than the majority, whereas people who were very much on the periphery did not have enough information about office actors to adequately assess office social structure.

Although there is a correlation between in-degree and medicinal plant remedy knowledge, it is relatively weak. This weak relationship is not surprising based on the low standard deviation and close range of in-degree and in-closeness scores, and the low network degree and closeness centralization scores. These scores all indicate a lack of variation in structural position as measured by degree, which means that difference in ability to influence the flow of medicinal plant remedy knowledge varies only minimally between individuals with low and high in-degree and in-closeness scores (Hanneman and Riddle 2005).

Although out-degree was not correlated with competence scores, there were some interesting ethnographic findings that related to out-degree. There were two individuals with particularly high out-degree scores relative to the other participants. Several years ago Miguel, a 51 year old, acquired a Divine Child (baby Jesus) doll, which is believed by some people of the
Catholic faith to have special healing powers. People travel from different villages to Miguel’s house to visit the Divine Child in hopes that it cures their ailments. Miguel uses prayers from the Bible to invoke the healing powers of the baby Jesus replica. He also occasionally uses herbal remedies to foster healing, and he expressed a desire to expand his use of herbal remedies. Community members of Tabi do not regard him as someone especially knowledgeable about medicinal plants, and I found no one from the community who believed in his ability to cure using the Divine Child. He stated that he was learning about medicinal plants through dreams. However, he identified 37 individuals in Tabi whom he had asked about medicinal plants, which suggests that he is learning about herbal remedies through extensive communication with his fellow community members. I believe his goal was to establish himself as a legitimate curer.

Maria also had an extraordinarily high out-degree score; she reported speaking with 35 different individuals in Tabi about herbal remedies. She explained to me that her husband’s family and another family in the community were constantly fighting with each other. Her husband had a series of illnesses that had been incurable using medicinal plant remedies known in the immediate family and by medications prescribed by a scientific medical doctor. She came to believe that the illnesses were caused by a curse placed on her husband by the family with which his family was feuding. Her extensive inquiry about medicinal plants was to find a cure for this curse.

Individual betweenness scores, like out-degree and out-closeness scores, were not correlated with competence scores. These three scores were correlated with each other; betweenness is moderately correlated with out-degree and out-closeness scores (r=0.58, p<0.01 and r=0.63, p<0.01, respectively, N=116), and out-degree and out-closeness scores are highly associated (r=0.90, p<0.01, N=116). Accordingly, people who asked a lot about medicinal plants
tended to be closer in the network to others who asked a lot about medicinal plants, and there
was a moderate tendency for them to be in the potentially advantageous position of being
situated between actors. In this network, however, high betweenness is not advantageous because
these individuals do not have higher competence scores than individuals with lower betweenness
scores. This finding is likely because of the low amount of hierarchy in the betweenness
structural position, as indicated by a fairly low mean betweenness score, a large proportion of
actors with 0 betweenness scores, and an extremely low network centralization index.

There were a few reasons why I used the community to define the boundaries of the whole
network. The goal of the project was to understand the social dynamics within a community and
how they related to knowledge distribution. Another reason was that I suspected that the
approximately 10 kilometer distance between Tabi and the nearest communities and the lack of
constant transportation \(^\text{16}\) would make communication about medicinal plants between
individuals in these communities more difficult and less frequent and, as a result, less influential
than communication with fellow community members. The results confirmed this by showing
that participants tended to ask more people living in Tabi about medicinal plants than people
living elsewhere. In addition, when I spoke with participants about their communication with
people outside of Tabi, many of them reported that they were one-time discussions, often with
strangers. Also, individual competence scores were not influenced by receiving information from
outside of the community, which further supports that these types of communications were
infrequent and did not lead to much acquisition of new medicinal plant remedy knowledge. The
limited communication about medicinal plants with people outside of Tabi may also be because
the community has been long established, information is freely available in Tabi, there is little

\(^{16}\) There is only one bus to Merida and back each day, and the only way to get to nearby towns is by hitching a ride.
in-migration and only seasonal and temporary out-migration, and there is no marketing and sale of medicinal plants by non-specialists and specialists only sell to their patients. The findings from this part of the study support the use of the community as the boundary for the whole network.

The results from the regression analysis show that nearly 28.4% of the variation in competence scores is explained by the model. Age is the only variable that explains any of the variation in the model after controlling for the other variables. Thus the response to the question posed at the beginning of the chapter is: individual network position, as measured by in-degree, in-closeness, and betweenness, does not explain any variation in medicinal plant remedy knowledge across households in Tabi while controlling for the individual attributes.

However, the results are more nuanced than the regression analysis divulges. A Pearson’s correlation showed that age and in-degree are positively correlated (r=0.48, p<0.01, N=116), which means that people who are more central in the medicinal plant remedy knowledge network tend to have more relative knowledge about medicinal plants. However, this positive association does not hold for all age groups when the data is divided into two age cohorts. The participants were divided into two age groups, young and old. Several different definitions of the age dividing the two groups were used and Pearson’s correlations between in-degree and age were run separately for each different division of the age groups. Using this technique it was determined that at 50 years of age, there was a shift in the relationship between age and in-degree. The analysis showed no relationship between age and in-degree in the participants ages 16–50 (r=0.19, p=0.10, N=72) and a positive relationship from 51 to 87 years of age (r=0.42, p<0.01, N=44) (Figure 5-9, Figure 5-10). Earlier it was reported that competence scores increased with age until the age of 45 when they leveled off.
These results interpreted together suggest a pattern of knowledge accumulation from young adulthood until the age of 45. A few years after knowledge acquisition ends, individuals start gaining status as knowledgeable individuals within the medicinal plant network. This pattern corresponds with the general respect for elders and the medicinal plant remedy knowledge they possess within the community of Tabi. Older individuals have gained valuable experience using medicinal plants while raising their children. That knowledge backed by experience is sought out by individuals with young children who have limited experience with herbal treatments. Additionally, it fits with the general belief that younger people know little about medicinal plants. After finishing an interview with a participant, they would frequently ask me who I was going to visit next. If I was speaking with an older individual and I was going to visit a younger member of the community, they would often say something regarding the lack of knowledge of the person I intended to interview. Then they would suggest two or three older individuals that I should interview. Also, on several occasions younger individuals suggested I interview older community members instead of themselves, citing their lack of knowledge compared to the older individuals. Lastly, older individuals have more spare time to help treat illnesses when they occur. One mother explained to me that she is really interested in medicinal plants but finds it difficult to learn about them with all the other things she is required to do as a mother of several young children. She chooses to take her children to her mother-in-law for treatment when they are ill. However, she recognizes she needs to learn the remedies so that she can use them and pass them on to her children after her mother-in-law dies.

**Conclusion**

Of the attribute variables included in this study, only a handful had an apparent effect on competence scores. Age and number of years living in Tabi were positively correlated with competence scores, and number of grades completed and lifestyle scores were negatively
correlated. In addition, literate people had a lower mean competence score than people who were illiterate. A few relational variables were also significant, including in-degree and in-closeness, both were positively related to competence scores. These findings support the second hypothesis that individual competence scores are positively associated with some individual structural positions including in-degree and in-closeness. In addition, people in cut-point positions had the highest competence scores, people in isolate positions had the lowest, and people within a bicomponent had intermediate scores. Variables unrelated to competence scores, included gender, livelihood, religion, illness treatment preferences, interest in medicinal plants, distance from Tabi where born, distance traveled, distance lived from Tabi, relative economic prosperity, out-degree, out-closeness, betweenness, and percentage of people communicated with from outside of Tabi. This last result failed to support the third hypothesis; individual competence scores were not negatively associated with the proportion of medicinal plant remedy knowledge ties an individual has outside of the community. The finding that betweenness was not positively associated with individual competence scores failed to support the second hypothesis that individual competence scores are positively associated with an individual’s structural position.

Several general patterns in knowledge acquisition and transmission were identified. Individuals begin accumulating knowledge about medicinal plants once they start having children. They continue to acquire knowledge from their family members, friends, neighbors, and healers until they reach the age of 45. A transition from accumulators of knowledge to disseminators of knowledge occurs between the ages of 45 and 50. Individuals over 50 are generally asked about medicinal plants and no longer seek out new information about herbal remedies.
Table 5-1. Relationships between mean herbal remedy competence scores and categorical attribute variables are tested. The variable was used to measure the underlying factor.

<table>
<thead>
<tr>
<th>Underlying factor</th>
<th>Variable</th>
<th>Test</th>
<th>Test statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Gender</td>
<td>t-test</td>
<td>1.18</td>
<td>0.24</td>
</tr>
<tr>
<td>Formal education</td>
<td>Literacy</td>
<td>t-test</td>
<td>2.01</td>
<td>0.05</td>
</tr>
<tr>
<td>Religion</td>
<td>All</td>
<td>ANOVA</td>
<td>1.38</td>
<td>0.20</td>
</tr>
<tr>
<td>Religion</td>
<td>Catholics, Protestants, atheists</td>
<td>ANOVA</td>
<td>2.29</td>
<td>0.11</td>
</tr>
<tr>
<td>Religion</td>
<td>Catholics and atheists</td>
<td>LSD</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Preference</td>
<td>Choice of health care provider</td>
<td>t-test</td>
<td>1.77</td>
<td>0.80</td>
</tr>
<tr>
<td>Preference</td>
<td>Treatment type</td>
<td>t-test</td>
<td>1.84</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table 5-2. Correlations between continuous attribute variables and medicinal plant remedy competence scores. The underlying factor the variable represents is also included.

<table>
<thead>
<tr>
<th>Underlying factor</th>
<th>Variable</th>
<th>r</th>
<th>r^2</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Age</td>
<td>0.45</td>
<td>0.20</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Formal education</td>
<td>Grades completed</td>
<td>-0.29</td>
<td>0.09</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Range</td>
<td>Years in Tabi</td>
<td>0.43</td>
<td>0.18</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Range</td>
<td>Distance lived from where born</td>
<td>0.02</td>
<td>0.00</td>
<td>0.81</td>
</tr>
<tr>
<td>Range</td>
<td>Farthest distance lived</td>
<td>0.12</td>
<td>0.02</td>
<td>0.18</td>
</tr>
<tr>
<td>Range</td>
<td>Distance traveled</td>
<td>-0.07</td>
<td>0.01</td>
<td>0.44</td>
</tr>
<tr>
<td>Relative economic prosperity</td>
<td>Relative economic prosperity</td>
<td>0.16</td>
<td>0.02</td>
<td>0.09</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>Lifestyle</td>
<td>-0.26</td>
<td>0.07</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Figure 5-1. The percentage of people who had completed each grade in school.
Table 5-3. Descriptive statistics for the experiences study participants from Tabi had traveling and living in other places.

<table>
<thead>
<tr>
<th>Measures of range</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family living in Tabi when born</td>
<td>88.80</td>
</tr>
<tr>
<td>Never lived anywhere but Tabi</td>
<td>81.00</td>
</tr>
<tr>
<td>Never left Tabi</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Figure 5-2. The percentage of people in each religion in Tabi. “Mixed” refers to one woman who described herself as both Catholic and Jehovah’s Witness.
Figure 5-3. The percentage of people in Tabi in different levels of relative economic prosperity using a scale developed locally. The scale consisted of five material items that varied in cost. Individuals on the low end of the scale had no high-priced material items, whereas individuals at the high end of the scale had all the material items.

Figure 5-4. The percentage of people in Tabi with different types of lifestyles using a scale developed locally. The items in the scale varied from behaviors that were considered traditional to modern behaviors. Individuals who scored low on the scale participated almost exclusively in traditional behaviors, whereas individuals who scored high participated mostly in modern behaviors.
Figure 5-5. The figure represents the medicinal plant inquiry social network in Tabi. The nodes are the individuals in the network, and the lines represent the relationship between them. The arrow indicates the direction of the relationship: individuals with arrows pointed toward them were asked about medicinal plants, so the potential flow of information goes in the opposite direction of the arrow. The individuals who asked about medicinal plants are located at the beginning of the arrow. The size of the nodes indicates the magnitude of the individual’s competence score: the larger the node, the higher the competence score. Shading represents in-degree: the darker the shading, the greater the in-degree of the node. In-degree is the number of individuals who have asked the participant about medicinal plants. The shapes represent different age cohorts: circles represent individuals 16–45 years old, circles within a square represent individuals 46–50 years of age, and squares represent individuals 51–87 years of age. The spring embedded graphic theoretical layout was used. The isolates (nodes that are not connected to any other nodes) were spread out manually for improved visualization.
Table 5-4. The relationship between mean herbal remedy competence scores and categorical relational variables. The mean competence score for individuals in cut-point positions varied from people in isolate positions.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Test</th>
<th>Test statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>ANOVA</td>
<td>3.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Isolate-bicomponent</td>
<td>LSD</td>
<td>0.10</td>
<td>0.48</td>
</tr>
<tr>
<td>Cut-point-isolate</td>
<td>LSD</td>
<td>0.16</td>
<td>0.02</td>
</tr>
<tr>
<td>Bicomponent-cut-point</td>
<td>LSD</td>
<td>0.06</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Table 5-5. Correlation between continuous relational variables and medicinal plant remedy competence scores. Competence scores were positively correlated with in-degree and in-closeness.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>r</th>
<th>r²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-degree</td>
<td>0.30</td>
<td>0.09</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Out-degree</td>
<td>0.14</td>
<td>0.02</td>
<td>0.14</td>
</tr>
<tr>
<td>In-closeness</td>
<td>0.29</td>
<td>0.08</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Out-closeness</td>
<td>-0.15</td>
<td>0.02</td>
<td>0.11</td>
</tr>
<tr>
<td>Betweenness</td>
<td>0.01</td>
<td>0.00</td>
<td>0.94</td>
</tr>
<tr>
<td>Proportion asked outside Tabi</td>
<td>0.08</td>
<td>0.01</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Table 5-6. Descriptive statistics for whole-network measures. Density measures the number of actual ties out of the number of possible ties. Fragmentation is the distance between nodes. Reach measures the proportion of individuals that are linked. Reciprocity represents the number of ties that are reciprocal. The centralization scores represent the amount of heterogeneity in centrality scores.

<table>
<thead>
<tr>
<th>Whole network measures</th>
<th>SD</th>
<th># of ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>0.02</td>
<td>0.13</td>
</tr>
<tr>
<td>Fragmentation</td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>Reach</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>Reciprocity</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>In-degree network centralization score (%)</td>
<td>14.80</td>
<td></td>
</tr>
<tr>
<td>Out-degree network centralization score (%)</td>
<td>30.60</td>
<td></td>
</tr>
<tr>
<td>Betweenness network centralization score (%)</td>
<td>1.89</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5-6. The bars represent the mean competence scores of individuals located in isolate (N=18), bicomponent (N=84), and cut-point (N=14) positions within the medicinal plant social network.

Table 5-7. Descriptive statistics for individual positional relational variables including mean, standard deviation, and range. In-degree and out-degree represent the number of individuals who asked the participant and the number of people the participant asked about medicinal plants, respectively. In-closeness and out-closeness are the number of individuals who have to communicate with the participant and the number of individuals the participant has to communicate with to transmit information to every other participant, respectively. Betweenness represents the number of times an individual needs to communicate with the participant to obtain or receive information from another individual.

<table>
<thead>
<tr>
<th>Positional measures</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-degree</td>
<td>2.11</td>
<td>3.08</td>
<td>0–19</td>
</tr>
<tr>
<td>Out-degree</td>
<td>2.11</td>
<td>5.50</td>
<td>0–37</td>
</tr>
<tr>
<td>In-closeness</td>
<td>3.53</td>
<td>3.86</td>
<td>1–22.42</td>
</tr>
<tr>
<td>Out-closeness</td>
<td>3.53</td>
<td>8.89</td>
<td>1–52.75</td>
</tr>
<tr>
<td>Betweenness</td>
<td>7.49</td>
<td>33.05</td>
<td>0–252.75</td>
</tr>
</tbody>
</table>
Figure 5-7. There is a positive association between competence score (agreement about medicinal plant remedies) and age ($r=0.46$, $p<0.01$, $N=59$) for individuals from 16 through 45 years of age.

Figure 5-8. There is no association between competence score (agreement about medicinal plant remedies) and age ($r=0.13$, $p=0.32$, $N=57$) for individuals from 45 through 87 years of age.
Figure 5-9. There is no association between in-degree and age for individuals from 15 through 50 years of age ($r=0.19$, $p=0.10$, $N=72$). In-degree is the number of people who have asked the participant about medicinal plants.

Figure 5-10. There is a positive association between in-degree and age for individuals from 51 through 87 years of age ($r=0.42$, $p<0.01$, $N=44$). In-degree is the number of people who have asked the participant about medicinal plants.
CHAPTER 6  
CONCLUSIONS

Studies found that variation in individual herbal remedy knowledge is associated with personal characteristics. Although common herbal remedy knowledge is shared through social network structures, very little research has been performed to assess the role of relational variables on knowledge distribution. The main question addressed in this study was: to what extent does individual network position explain variation in herbal knowledge across households in a Yucatec Maya community in Mexico, independent of attribute characteristics of the individual? Three objectives were addressed to achieve an understanding of the relationships between individual medicinal plant remedy knowledge and relational and attribute variables. The objectives were:

- Identify the common herbal remedies known
- Assess the variation in knowledge about medicinal plants
- Evaluate the relationship between the distribution of medicinal plant remedy knowledge and attribute and relational variables

The study was conducted in a Yucatec Maya community selected because of the long history of occupation of the region, their extensive use of medicinal plants to treat illnesses, and their ability to adapt and incorporate knowledge and practices of other culture groups into their own cultural schema. The research was carried out in Tabi, Yucatan, Mexico. Tabi was selected for its small population size, its high percentage of people working in agriculture, its high percentage of bilingual Maya and Spanish speakers, and the continued use and interest of community members in treating common illnesses with medicinal plants.

This study contained unstructured and structured methodological phases. Methods focused on gathering information about herbal remedies from the general population in Tabi. The purpose of the unstructured phase was to address the first objective, to collect data to help create
culturally appropriate questionnaires for testing hypotheses related to the second two objectives, and to gather information on the context of the results of the questionnaires. The methods used during the unstructured phase were participant observation, free-listing, open-ended interviews, and collection of ethnobotanical specimens. The structured stage consisted of structured interviews with a variety of questionnaires including a medicinal plant exam, a demographic household survey, and a whole network and personal network questionnaires. The medicinal plant exam developed from the free-list results was used to determine relative individual knowledge levels. Participant observation and open-ended interviews were used to develop the demographic household survey, which included measures of the different attribute variables of interest in this study. The whole network and personal network data were developed from a list of community members and open-ended interviews and they were used to measure relational variables.

The free-list data addressed the first objective of identifying the common herbal remedies known. A total of 650 herbal remedies were reported by the 40 adults who participated in this activity. The remedies were composed of 276 different plants and 107 different illnesses. The results of this activity also helped identify the distribution of medicinal plant remedy knowledge in the community, which addresses the second objective of the study. A large portion of the remedies (84%) were reported by one individual. The frequency of people who mentioned each remedy ranged from 2.5% to 50%. The percentage of plants reported only by one person as being used in herbal remedies was 47%, and the frequency of people who reported each of the plants as being used in a remedy ranged from 2.5% to 82.5%. The distribution of knowledge identified using the free-listing results is similar to results from studies on distribution of medicinal plant knowledge in Latin America and Africa (Barrett 1995, Casagrande 2002, Friedman et al. 1986).
The amount of idiosyncratic medicinal plant knowledge in Tabi was 47%, and the range in other studies was 40%–50% (Alexiades 1999, Barrett 1995, Johns et al. 1990, Johns, Kokwaro, and Kimanani 1990). In addition, the percentage of plants identified by more than than three people as medicinal in previous studies was between 15% and 50% (Barrett 1995, Friedman et al. 1986, Johns et al. 1990); in Tabi it was 39%. Only three or fewer medicinal plants were known by the majority of community members in previous studies (Barrett 1995, Casagrande 2002). In Tabi the three most widely known plants were reported by 82.5%, 65%, and 55% of the people interviewed. Thus the free-list data from Tabi, like data from other areas of Latin America and Africa, supported the hypothesis that some knowledge of herbal remedies is distributed widely among the community; but, more than 40% of the remedies are known by only one person.

This finding was further tested using a medicinal plant exam based on the frequencies of reporting of each remedy from the free-list analysis. One member of each household (116 people total) was administered the exam and responses were analyzed using CCA. The analysis provided individual competence scores that are measures of individual medicinal plant remedy knowledge based on agreement with other participants in the study. The results of the factor analysis showed that the ratio between the first factor and the second factor was 15.011. This result showed that there is one medicinal plant remedy model in Tabi and that the individual competence scores are an accurate measure of medicinal plant remedy knowledge. The individual competence scores ranged from almost no competence to almost full competence (0.10 to 0.95). So even though there is one model of medicinal plant remedies, the participants vary greatly in their proficiency of the model (Boster 1985). Anderson (2003) reported similar findings among the Yucatec Maya in Chunhuhub, Quintana Roo.
The third objective, which was to evaluate the relationship between the distribution of medicinal plant remedy knowledge and attribute and relational variables was addressed by relating the individual competence scores with attribute and relational data. In addition, the main research question and the following two hypotheses were tested with these data.

- **H2**: Relative levels of herbal knowledge (cultural competence scores) are positively associated with the individual’s position (in-degree, in-closeness, and betweenness scores) within the medicinal plant remedy knowledge inquiry network.

- **H3**: The proportion of ties in an individual’s medicinal plant remedy knowledge inquiry network that are with people outside of the community are negatively associated with their relative level of herbal knowledge (cultural competence score).

A few relational variables were related to competence scores; in-degree and in-closeness were positively correlated with competence scores, but betweenness was not. Thus the second hypothesis holds true for in-degree and in-closeness but not betweenness. The structure of the network—including characteristics like low density, low number of two-way ties, large number of points in one component, and low betweenness centralization—likely explains why betweenness was not correlated with competence scores. The proportion of medicinal plant ties an individual has outside of the community was not associated with competence scores, which disproves the third hypothesis. The lack of significance is likely a result of the low number of individuals who communicated with people outside of Tabi about herbal remedies and that the communications that did occur were usually infrequent and with strangers.

Several attribute variables were correlated with competence scores; age and number of years living in Tabi were positively associated, whereas the association between number of grades completed, literacy, and lifestyle scores was negative. The remaining attribute variables measured in this study (gender, livelihood, religion, individual interest in medicinal plants, range and migration, and economic prosperity) were not associated with competence scores. In a multiple regression analysis, only age explained any of the variation after controlling for all other
variables. Thus the answer to the main research question is that relational variables in this study do not explain any of the variation in relative individual herbal knowledge above and beyond what was explained by age. However, when the sample was divided into two age groups, the relationship between consensus and age varied, as did the relationship between age and in-degree. There was a positive correlation between competence scores and age in the 16–45 group and no relationship between the two variables in the individuals over 45. This suggests that knowledge acquisition generally occurs through childrearing years and levels off as adults age and become grandparents. Around 50 years of age, individuals shift from being seekers to providers of information, as was shown in the lack of relationship between in-degree and age in people younger than 50 and the positive correlation between age and in-degree in people 50 to 87 years old.

**Future Directions and Limitations to the Study**

There are many important areas for future study. For example, less than a third (28.4%) of the variation in individual medicinal plant remedy knowledge was explained by the variables measured in this study. What might account for the rest of the variation? It is possible that more of the variation could have been explained had different measures been utilized for some of the complex concepts such as lifestyle, relatively economic prosperity, and individual interests and motivations. Thus one of the limitations of the study is the survey instruments used to measure complex concepts. In particular, in place of measuring changes of lifestyle, a more accurate tool for measuring acculturation is desirable because it is an important intervening variable between age and knowledge scores. Further research and refinement of these tools may increase the amount of variation in responses explained by the model. In addition, the inclusion of other relevant variables such as the prevalence of disease conditions within households (Alexiades 1999, Trotter and Logan 1986), the spatial distribution of plants used as medicine from each
household (Anyinam 1995, Caniago and Siebert 1998, Casagrande 2002, Trotter and Logan 1986), restrictions in access to resources based on formal institutions and informal social rules (Ghimire, McKey, and Aumeeruddy-Thomas 2004), the prevalence of innovation (Bernard 2002) and experimentation (Gaskins 1999) of individuals within the household, years of experience with medicinal plants (McMillen 2008), frequency of use of herbal remedies (Casagrande 2002), emic perceptions of efficacy (Casagrande 2002, Johns et al. 1994), extent to which life skills are disseminated to all members or a particular group within the community (Johns et al. 1994), and cultural bonds to the land (Ghimire, McKey, and Aumeeruddy-Thomas 2004) may help explain more of the variation in future studies.

Another item of interest from the findings was that even though a few of the relational variables explained some of the variation in medicinal plant competence scores, they were not able to explain variation above and beyond that of the attribute variable of age. These results may falsely lead some researchers to conclude that it is a waste of time to include network variables in studies of intra-cultural knowledge variation. There are very few studies that look at the explanatory power of both attribute and relational variables, more studies of this type need to be done to assess the importance of including relational variables. In addition, comparative studies are importance in determining whether network analyses are worthwhile. One limitation of this study is that there was no comparison between different medicinal plant networks. In this study, the low density and high percentage of one-way ties and low in-degree centralization score help explain why in-degree was not more influential in shaping competence scores. The influence of relational variables in networks with different structural characteristics is likely to be more pronounced than they were in this study. Thus there is a need for more studies of this kind to help determine the relationship between network structure and position on knowledge. In
addition, studies comparing the overlap between different types of networks within a community, such as medicinal plant networks and friendship and kinship networks, will help to gain a better understanding of the influences of different relationships on knowledge acquisition. Studying the same social-network question in communities of different sizes and with different network characteristics may also help to determine the relationship between network characteristics and flow of information.

Besides the structural characteristics of the network, another reason for the relatively low association between relational variables and relative medicinal plant remedy knowledge as measured by competence scores may be the network question that was asked. A limitation to this study is that the network question asked determined the entire range of medicinal plant communication in Tabi, but it did not capture the nuances of everyday communication. Questions regarding communication about medicinal plants on shorter time scales may produce networks where people’s positions are more strongly associated with their competence scores. I chose to measure relationships over a long time scale because presumably the knowledge that was expressed in the competence score was accumulated over the lifetime of the individual. In addition, even though long-term memory is often scanty and biased when it is compiled across individuals, it provides a fairly accurate representation of norms (D'Andrade 1995). However, reporting relationships over a shorter time scale is likely to provide a more accurate understanding of current patterns in knowledge transmission, and individuals will likely have greater recall of remedies they have heard often (Boster 1991) and recently (cf. Bernard et al. 1984 for review of informant accuracy); therefore, the positive association between network position and competence scores may be greater in short-term communication networks. In addition, frequency of communication between individuals could help explain patterns of
knowledge more completely. It is likely that a stronger association in knowledge exists between people who communicate more frequently with one another than those who communicate less frequently. This needs to be tested to confirm that prediction.

Another important area for further study is the need for separate assessments of herbal knowledge distribution in different ethnobotanical domains. The relatively limited number of studies of knowledge transmission in any particular ethnobotanical domain (Reyes-Garcia et al. 2007) often results in researchers using information from different domains to support their findings. This can be problematic because access, motivation, and abilities to obtain and organize information often vary by domain (Boster 1991) and can result in differences in knowledge distribution (Phillips and Gentry 1993a). An increase in number of studies on patterns in knowledge distribution will also help improve researchers’ understanding and ability to explain the mechanisms behind the patterns within each domain. In this study care was taken to only use evidence from medical ethnobotanical literature to support the findings; however, in the case of some variables, that was difficult because of the limited number of studies available. A limitation of this study is the exclusive focus on the domain of medical ethnobotany. If patterns in different ethnobotanical domains had been compared in this study, knowledge domains similar in their patterns could have been identified and used to support the findings in the domain of medical ethnobotanical knowledge with greater confidence. It is recommended that in future studies knowledge in a variety of ethnobotanical domains is gathered and patterns are compared.

A major obstruction to building theoretical models is the lack of consistency in methods used to measure knowledge and a lack of understanding of how the results from these measures of knowledge compare to one another. Studies comparing the different measures of knowledge will help researchers make comparisons between results that have already been obtained using
different methods. In addition, it will help researchers determine which method would be the best to use in the future. The comparison of studies of individual knowledge variation between domains and studies using different methods to measure individual knowledge can result in contradictory results (Reyes-Garcia et al. 2007) and seriously limit the ability of researchers to develop widely applicable models of knowledge distribution. An additional limitation to this study is that only one measure, CCA, was used to estimate knowledge. CCA may be better at determining which individuals have the most average knowledge instead of the individuals who have the most knowledge (Boster, Johnson, and Weller 1987). Thus other measures of knowledge may correlate higher with network variables. More research needs to be done to compare different techniques to measure knowledge in order to determine which technique or suite of techniques is best to use to measure medicinal plant remedy knowledge (Reyes-Garcia et al. 2007, Reyes-Garcia et al. 2008b).

Individual knowledge is the outcome of the processes of acquisition of that knowledge. Research interested in acquisition processes tend to focus on the outcome of acquisition to help understand it because acquisition is difficult to witness. Studies of children’s ethnobotanical knowledge are particularly important because they help researchers determine the timing of acquisition. The few studies that have focused on the timing of acquisition of ethnobotanical knowledge generally show that acquisition begins early in childhood and children reach adult comprehension around 12 to 14 years old (Lozada, Ladio, and Weigandt 2006, Stross 1973, Zarger and Stepp 2004, Zarger 2002a). However, very few of those studies were done solely in the domain of medicinal plants, and of the studies done in that domain, the results are conflicting. Lozada and colleagues (2006) found in an extremely rural community in Patagonia, Argentina, that the majority of medicinal plant acquisition occurred in childhood. Phillips and
Gentry (1993a) found in Tambopota, Peru, that knowledge of medicinal uses of woody species gradually increased over the lifetime of the participants. They argue that this could be because of acculturation or because of the complexity of herbal remedies as compared to other types of ethnobotanical knowledge. In addition, in Tabi people reported that they learned the bulk of their knowledge about medicinal plants once they were adults and had children of their own. Since there is at least one study that reports medicinal plant knowledge acquisition occurring mostly in children, the argument that herbal remedies are more difficult to learn is less likely to be influencing the delay in acquisition of medicinal plant knowledge in Tambopota and Tabi than lifestyle changes. However, more studies need to be done to specifically test this important hypothesis before it can be proven or disproven. One limitation of this study is that it took place in one community with limited absolute variation in types of lifestyles. Studies comparing knowledge acquisition in communities with different levels of exposure to the dominant culture or studies done in communities with individuals with a wide range of exposure to other cultures would greatly help in understanding the relationship between acculturation or lifestyle changes and medical ethnobotanical knowledge (cf. Zent 2001).

Another limitation to this study is that patterns in knowledge and transmission networks are probably not compared to knowledge systems at different stages of derivation from their maximum potential. However, the processes affecting knowledge acquisition and transmission are not unique to Tabi, and communities like Tabi are rapidly becoming the norm. This suggests that the findings in this study are comparable to other communities where people are predominantly subsistence farmers, bilingual in their native and national languages, have access to scientific medicine, and have increasing contact with the national culture. The approach used in this study to measure social knowledge and its relationship to personal characteristics and
relational variables is not limited to studies of degraded knowledge systems. It will work well in all types of knowledge systems. Dynamism and derivation from the maximum potential of social knowledge cannot be fully understood without studying all types of systems and determining the factors that influence the knowledge available in each (See Zent 2001, Zent and López-Zent 2004 for example of study which compares knowledge in communities with varying degrees of acculturation). Longitudinal studies are also an excellent way of assessing changes over time (See Zarger and Stepp 2004). Thus more studies need to be done using these approaches to better understand social knowledge acquisition and distribution under various conditions. Preliminary comparisons between studies suggest that ethnobotanical knowledge is acquired earlier in life and there is less variation between individuals in communities with less disruption of daily life by external processes than in communities with more changes (Lozada, Ladio, and Weigandt 2006, Ohmagari and Berkes 1997, Zarger and Stepp 2004, Zent 2001, Zent and López-Zent 2004).

Another area of research that needs to be further developed is the amount of knowledge sharing that occurs between people within one household and the factors that influence that sharing. Many studies have attributed differences in the amount of herbal knowledge between men and women to gender roles (Arias Toledo, Colantonio, and Galetto 2007, Camou-Guerrero et al. 2008, Caniago and Siebert 1998, Pilgrim, Smith, and Pretty 2007, Quinlan and Quinlan 2007, Voeks 2007). However, in Tabi, even though there is a strong division in gender roles, men and women were equally knowledgeable and they reported sharing in the responsibility of treating their children’s illnesses within the household. Casagrande (2002) also found that treating illnesses was often a familial affair. There are two issues that may be of particular interest to patterns of knowledge within a household. The first is when the knowledge is learned.
If the bulk of the knowledge is learned in childhood before gender divisions of labor occur, then differences in knowledge between men and women may be less than in cases where acquisition takes place once gender divisions occur. In addition, the amount of communal decision-making will also influence the distribution of knowledge within a household. If all members of the household are involved in the decision-making process, then knowledge would likely be more homogenous than if only one individual is responsible for treating illnesses. Clearly more research needs to be done on timing of acquisition and treatment decision-making within a household.

Contributions of Study to Anthropology, Ethnobotany, and Conservation

The last section of this conclusion focuses on the contributions of this study to anthropology, ethnobotany, and conservation. Systematic variation in cultural knowledge was first recognized in the 1930s (Sapir 1938); however, it did not become widely accepted in anthropology until the 1960s (Boster 1987, Pelto and Pelto 1975, Roberts 1961, Roberts 1964, Wallace 1961). Some studies have attempted to explain patterns in cultural knowledge through the mechanism of knowledge transmission (Casagrande 2002, Hewlett and Cavalli-Sforza 1986, Ohmagari and Berkes 1997, Ruddle 1993, Ruddle and Chesterfield 1977). These studies have led to an increase in our understanding of modes of knowledge transmission and influence of personal attributes on the distribution of knowledge within cultural groups. However, relationships between people and the potential for those relationships to influence knowledge transmission were missing from these studies. This project helped fill that gap by quantifying relationships between individuals by measuring and analyzing aspects of social network structure and individual position using SNA. It was determined that individuals who were asked by a large number of people about medicinal plants were more knowledgeable than individuals who were asked by few people and the people who were closely tied to those individuals were also more
knowledgeable. In addition, individuals who were not connected to the network had less knowledge than people who were a part of the network. This information was paired with individual personal attributes to help describe variation in knowledge between individuals. The findings showed that an individual’s role in the medicinal plant knowledge acquisition process was accumulator of knowledge until they age of 45. Around the age of 50 individual’s role shifted to knowledge disseminator and the number of people they disseminated to increased with age.

Another contribution this study makes to anthropology is the combining of CCA and SNA to measure the influence of relational variables on intra-cultural knowledge variation. The combination of these methods is rare (cf. Boster, Johnson, and Weller 1987 for notable exception); however, it has the potential to become a powerful tool to understand and build theory about knowledge transmission and distribution because of the ability of these methods to produce data that is comparable between studies, across research sites, and through time. Using this methodology in more intra-cultural knowledge studies will help determine the conditions for widespread knowledge transmission in a community.

Since ethnobotany’s inception in the 1890s, three main approaches have been developed. The first approach was the utilitarian approach, which focuses on the description of peoples’ uses of plants (Harshberger 1896). The intellectual approach developed in the 1950s focuses on how people organize plants, animals, and their environment in their minds (Berlin, Breedlove, and Raven 1966, Conklin 1954b). And in the 1980s, many ethnobotanists became interested in addressing more applied research topics that could be directly related to conservation and pharmaceutical discovery. Quantitative methods are often used to help them answer their
research questions. Utilitarian, intellectual, and quantitative approaches are still being used by ethnobotanists today with an emphasis on applied and quantitative studies.

Ethnobotany as a discipline is deficient in theory for the most part. This is partly because of the relatively young age of the discipline and partly due to the delay in adoption of research practices that are comparable across studies. Although descriptive studies are beneficial because they provide a general understanding of people’s use of the natural resources in their environment and a baseline for measuring changes in knowledge and behavior over time, they have not contributed much to the development of theory in ethnobotany. Some important theoretical developments occurred under the intellectual approach, most notably Berlin’s universal principals of categorizing plants (Berlin 1992). The paradigm shift to quantitative studies has the potential to foster theoretical development even further because of the ability to compare information gathered using systematic methods. Through the development and utilization of methods that produce comparable data across places and time, ethnobotanists will be able to construct theories related to patterns in local knowledge and resource uses. In addition, the development of multidisciplinary research groups—such as Godoy and Reyes-García’s Tsimane Amazonian Panel Study\(^1\) that gathers quantitative ethnobotanical data over several years and Vogl’s Dynamics of Local Knowledge Study\(^2\), which is gathering the same data in several locations at the same time—is particularly helpful for the development of theory in ethnobotany.

Unfortunately, comparison between quantitative studies is still difficult because of the wide range of methods used to measure ethnobotanical data. One example of this is the wide range of methods used to measure ethnobotanical data. One example of this is the wide

\(^{1}\) See http://www.tsimane.org/ for more information on the project.

\(^{2}\) See http://www.nas.boku.ac.at/dynamics_of_local_knowledge.html for more information on the project.
variety of methods used to measure individual ethnomedical knowledge (Reyes-Garcia et al. 2007). A comparison of the different methods and a standardization of the methods would foster cross-study comparisons and help with research development. This study is an example of how to carry out a research project that can lead to theoretical developments in ethnomedicine; highly developed mathematical models were used to measure knowledge and the social networks through which ethnomedical knowledge is transmitted. This study can be used as a methodological model for other ethnomedical studies to help increase the reliability of comparisons between studies and improve our ability to explain patterns in variation in individual ethnomedical knowledge.

The other contribution this study makes to ethnomedicine is it provides an example of how to test the explanatory power of a whole suite of variables. Many of the quantitative ethnomedical studies focus on a few variables while ignoring the potential of other variables to influence the dependent variable (Arias Toledo, Colantonio, and Galetto 2007, Begossi 2002, Voeks 2007). Other studies include several variables, but they fail to use statistical tests to measure the combined ability of those variables to explain patterns in the dependent variable (Quinlan and Quinlan 2007, Voeks and Leony 2004). This study determined the relationship between a variety of independent variables and individual medical ethnomedical knowledge. Then statistical tests were performed to determine how much each of those variables contributed to explaining the variation in knowledge. The model developed in this study to explain variation in herbal knowledge in Tabi can be replicated in other places to help build a theory of patterned variation in individual medical ethnomedical knowledge. As our understanding of the influences on herbal knowledge becomes greater, additional variables could be added to the model to help increase the explanatory power. Over time, researchers will be able to deconstruct the complex
nature of patterns in knowledge. In brief, this study contributes to the development of
ethnobotanical theory in two ways. It provides a case study of the relationship between some
relational and attribute variables and relative individual medicinal plant remedy knowledge
levels. In addition, because of the systematic way in which the data was collected, the findings
can be compared with other studies on intra-cultural medicinal plant remedy knowledge variation
to further develop ethnobotanical theory.

There are several contributions this study makes to conservation. The first is that
individuals who were particularly influential in the dissemination of medicinal plant remedy
knowledge were identified by using a combination of CCA and SNA. Those individuals were
traditional healers and people recognized by the community as being knowledgeable about
medicinal plants. A very interesting and applicable finding is that knowledgeable non-specialists
had higher competence scores than specialists; this is likely because competence scores measure
relative knowledge and knowledgeable non-specialists’ knowledge is more similar to the average
common knowledge maintained by the general public than curers’ knowledge. Anthropologists
should work closely with the individuals identified as influential and knowledgeable in the
network to gain a greater understanding of the common knowledge, use, and management of
medicinal plants in Tabi. Then this more detailed information can be used to help inform policy
makers about regional best practices for medicinal plants.

The second contribution this study makes to conservation is that SNA was used to identify
people who are in positions within the network to influence the flow of knowledge. Both
knowledgeable non-specialists and specialists were important in controlling the flow of
information. Thus researchers can work closely with these individuals to facilitate the diffusion
of well-informed conservation policies and educational initiatives. Both of these contributions to
conservation are extremely important, especially in areas where agricultural practices and use of natural resources have changed significantly. In the Maya region of Mexico, people are moving away from strict subsistence agriculture to both market and subsistence production. In addition, the government has implemented many agricultural programs to modernize agriculture in the region. These changes have resulted in some unintended negative consequences that could have been avoided if there had been more exchange in information occurring between the government and the peasants. The methods used in this dissertation could help foster that exchange. This study could also be used to modify formal education to help foster herbal knowledge acquisition at a younger age. The development of a curriculum on medicinal plants would improve the prestige of herbal medicine and help the youth develop knowledge that they will need once they have a family of their own.

The third contribution of this study to conservation is by combining CCA and SNA, researchers can identify holes in the social networks and help create connections between individuals to foster knowledge transmission. The conservation of herbal knowledge continues to be important, especially in areas where wage labor is unreliable and local agriculture remains an important part of subsistence practices. Unfortunately, external forces such as participating in a market economy and attending school often lead to decreased acquisition of local knowledge in childhood. However, once these children grow into adults, they often realize they need the information they did not acquire in their childhood. Thus they scramble to acquire the knowledge. In some cases it is still available, but in other cases the keepers of the knowledge are no longer living or the generational gap between the two is too wide for effective communication to occur. Cultivating critical relationships could lead to increased knowledge diffusion at younger ages and help decrease local knowledge loss.
This study found that the links for transmission of medicinal plant remedy knowledge between households in Tabi were relatively sparse. Thus efforts need to be made to create new pathways and to maintain those that already exist to help diffuse and conserve herbal knowledge. The first step to this process is to convince community members of the utility of medicinal plants and to help increase prestige related to its use. This can be done through government media campaigns and workshops given in conjunction with scientific health care professionals and the individuals who have been identified as knowledgeable and influential in the local medicinal plant network. The purpose of these workshops would be to show that the use of traditional and scientific medicine can be used in tandem to provide more comprehensive rural health care than either one could provide on its own. The history of use of herbal remedies by the Maya and the specific benefits of using herbal remedies, such as high availability, low costs, and low side effects, should be emphasized. Once the campaign has been shown to improve public opinion of the use of herbal remedies, then researchers can focus on forging new pathways for knowledge transmission. New pathways can be created through providing spaces where community members can share herbal remedies. These spaces would be open to all community members to help foster the building of their own medicinal plant networks. Further network studies could be done after the development of these platforms to determine their effectiveness. If important holes in the network are still identified, then researchers could hold workshops with specific individuals to help foster communication between them and bridge gaps in the network. In conclusion, cooperation between influential community members, government health care employees and officials, and researchers can help improve rural health care and lead to better management of natural herbal resources.
### APPENDIX A

#### RESEARCH TIMELINE

Table A-1. Timeline the research for this study was performed

<table>
<thead>
<tr>
<th>Date</th>
<th>Research activities</th>
</tr>
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<tbody>
<tr>
<td>June–July 2005</td>
<td>Met with potential collaborators, began collaboration with Dr. Juan Jimenez at UADY, and performed library research at CICY, UADY, and CINVESTAV</td>
</tr>
<tr>
<td>June–July 2006</td>
<td>Attended language training in Yucatec Maya in the state of Yucatan, acquired maps and census data from INEGI, and visited ethnobotanical researchers in Yucatan to discuss research project</td>
</tr>
<tr>
<td>December 2006</td>
<td>Selected potential research sites using INEGI data</td>
</tr>
<tr>
<td>February 2007</td>
<td>Visited potential research sites in the state of Yucatan</td>
</tr>
<tr>
<td>March 2007</td>
<td>Prepared to enter the field</td>
</tr>
<tr>
<td>April 2007</td>
<td>Started fieldwork, gained community support, obtained the sampling frame, obtained plant collection permit, and performed participant observation and remedy free-listing</td>
</tr>
<tr>
<td>May 2007</td>
<td>Continued free-listing and participant observation</td>
</tr>
<tr>
<td>June 2007</td>
<td>Selected participants for structured interviews, completed open-ended interviews on wealth and lifestyle change indicators, performed participant observation, and wrote structured interview questions</td>
</tr>
<tr>
<td>July 2007</td>
<td>Hired research assistants; edited, translated, and pretested structured interview questions; performed open-ended interviews on illnesses; and gathered ethnobotanical specimens</td>
</tr>
<tr>
<td>August 2007</td>
<td>Continued to pretest the structured interview questions</td>
</tr>
<tr>
<td>September–October 2007</td>
<td>Carried out structured interviews and participant observation</td>
</tr>
<tr>
<td>November 2007</td>
<td>Performed structured interviews, completed open-ended interviews on medicinal plant preparation methods, and gathered ethnobotanical specimens</td>
</tr>
<tr>
<td>December 2007</td>
<td>Prepared medicinal plant recipe book</td>
</tr>
<tr>
<td>January–March 2008</td>
<td>Analyzed data</td>
</tr>
<tr>
<td>April 2008</td>
<td>Completed participant observation, performed medicinal plant exam structured interview, and inquired about reasons for some of my findings</td>
</tr>
<tr>
<td>May 2008</td>
<td>Analyzed data</td>
</tr>
<tr>
<td>June 2008</td>
<td>Presented preliminary results at the Society for Economic Botany annual meeting in Durham, North Carolina</td>
</tr>
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APPENDIX B
MEDICINAL PLANT REMEDY RECIPE BOOK

67 Remedios Caseros Comunes en Tabi, Yucatán

67 Tzakoob ku mas Meyaj tii Tabi, Yucatán

Allison Louise Hopkins
2008
## Contenido

<table>
<thead>
<tr>
<th>Parte</th>
<th>Pág.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agradecimientos</td>
<td>5</td>
</tr>
<tr>
<td>Introducción</td>
<td>6-9</td>
</tr>
<tr>
<td>Remedios para:</td>
<td></td>
</tr>
<tr>
<td>Aire en el estómago</td>
<td>10-11</td>
</tr>
<tr>
<td>Asma</td>
<td>12</td>
</tr>
<tr>
<td>Bichos</td>
<td>13-15</td>
</tr>
<tr>
<td>Caída del cabello</td>
<td>16</td>
</tr>
<tr>
<td>Calentura</td>
<td>17</td>
</tr>
<tr>
<td>Calentura en el estómago</td>
<td>18</td>
</tr>
<tr>
<td>Caspa en el cabello</td>
<td>19</td>
</tr>
<tr>
<td>Cólico</td>
<td>20-21</td>
</tr>
<tr>
<td>Comezón</td>
<td>22</td>
</tr>
<tr>
<td>Cuando se seca la leche de una mamá</td>
<td>23-24</td>
</tr>
<tr>
<td>Diabetes</td>
<td>25-26</td>
</tr>
<tr>
<td>Diarrea</td>
<td>27-37</td>
</tr>
<tr>
<td>Disentería</td>
<td>38-41</td>
</tr>
<tr>
<td>Dolor de cabeza</td>
<td>42-44</td>
</tr>
<tr>
<td>Dolor del estómago</td>
<td>45</td>
</tr>
<tr>
<td>Dolor de oído</td>
<td>46-47</td>
</tr>
<tr>
<td>Dolor de ojo</td>
<td>48</td>
</tr>
<tr>
<td>Dolor de nuca</td>
<td>49-51</td>
</tr>
<tr>
<td>Fogajes</td>
<td>52-54</td>
</tr>
<tr>
<td>Gastritis</td>
<td>55</td>
</tr>
<tr>
<td>Granos</td>
<td>56-57</td>
</tr>
<tr>
<td>Infección de la vejiga</td>
<td>58</td>
</tr>
<tr>
<td>Infertilidad</td>
<td>59</td>
</tr>
<tr>
<td>Mal de ojo</td>
<td>60-62</td>
</tr>
<tr>
<td>Mordedura de serpiente</td>
<td>63-64</td>
</tr>
<tr>
<td>Espasmo del estómago</td>
<td>65</td>
</tr>
<tr>
<td>Espasmo de la sangre</td>
<td>66</td>
</tr>
<tr>
<td>Piedras en los riñones</td>
<td>67</td>
</tr>
<tr>
<td>Quemadas</td>
<td>68</td>
</tr>
<tr>
<td>Saca una espina</td>
<td>69</td>
</tr>
<tr>
<td>Tos</td>
<td>70-73</td>
</tr>
<tr>
<td>Verrugas</td>
<td>74</td>
</tr>
<tr>
<td>Vómito</td>
<td>75-76</td>
</tr>
<tr>
<td>Índice de nombres comunes</td>
<td>77</td>
</tr>
<tr>
<td>Índice de nombres científicos</td>
<td>78</td>
</tr>
<tr>
<td>Índice de enfermedades</td>
<td>79</td>
</tr>
</tbody>
</table>
K’ala’an

Juntséel ju’un

Dyos bo’otik..................................................5
U kajbal.................................................................6-9
Tzakoob utta’al:

U yik’al nak’..........................................................10-11
K’aak’as se’en.........................................................12
U yik’el u nak’ mak................................................13-15
Luubul ts’otsel pool..............................................16
Chokuil.................................................................17
Chokuil nak’..........................................................18
Caspa.................................................................19
Ch’ot nak’..............................................................20-21
Sa’asak’ wünkila...................................................22
Mina’an u k’ab yim un tul koolel yanu chambal................23-24
Ch’uujuk wix..........................................................25-26
Waah’ k’aja............................................................27-37
K’iik’ nak’..............................................................38-41
Chiibal pool..........................................................42-44
Chi’ibal nak’..........................................................45
K’i’inan xikin..........................................................46-47
K’i’inan ieh.............................................................48
K’i’inan koj..............................................................49-51
K’aak’.................................................................52-54
Ele’ maak’.............................................................55
Mejen chuchun.......................................................56-57
Yaya’ wix..............................................................58
Utul ko’ole maa tu paa tu ts’iik paal..............................59
K’ak’as ich............................................................60-62
Chi’ibal kaan..........................................................63-64
Tu’u kee...............................................................65
K’iik’ pasmado........................................................66
Piedra.................................................................67
Chuuju...............................................................68
K’i’ix.................................................................69
Sasaa kal.............................................................70-73
Ax.................................................................74
Xe’.................................................................75-76
Tzolaantakoob tii u k’abaa indice...................................77
U k’abaa científico índice...........................................78
K’ojaanloob indice..................................................79
Agradecimientos

Este libro fue posible gracias al apoyo de personas e instituciones. En primer lugar agradezco a la Universidad de Florida, la cual a través de su departamento de antropología me dio la oportunidad de continuar con mi desarrollo académico y profesional dentro de su programa de doctorado. También quiero agradecer a la Fundacion Nacional de la Ciencia, de los Estados Unidos de América (National Science Foundation), a través del programa de becas “Trabajando Bosques en los Trópicos” (Working Forests in the Tropics) por su apoyo económico para la realización de mis estudios de doctorado. De igual manera quiero agradecer a todos los profesores y personal involucrados con el programa de “Trabajando Bosques en los Trópicos” por sus cursos maravillosos y su apoyo logístico. Agradezco a mi asesor principal en la Universidad de Florida, Dr. Richard J. Stepp, por sus consejos intelectuales, y al apoyo logístico e intelectual que el Dr. Juan Jimenez, del departamento de manejo y conservación de recursos naturales tropicales de la Universidad Autonoma de Yucatan, me ha dado.

En particular, quiero dar gracias a la Fundacion Nacional de la Ciencia, por el apoyo económico para realizacion de mi proyecto de investigación doctoral y del cual este libro forma parte. El trabajo de campo fue realizado a través de los permisos otorgados por las autoridades de los Estados Unidos Mexicanos y por las autoridades del municipio de Sotuta y el pueblo de Tabi del Estado de Yucatán. Doy mi agradecimiento más sincero a toda la gente del pueblo de Tabi, por estar dispuestos a colaborar dentro de este proyecto. Un agradecimiento especial a Doña Gloria de Sotuta por permitirme vivir en su casa por algunos meses, a Doña Eloisa Canche Chan y Don Maximiliano Cetz Pech de Tabi, por abrir su casa y sus corazones. También doy gracias a Guadalupe Chan Poot y Layda Chan Ku por todos sus esfuerzos y ayuda en la realización de este proyecto. Quiero agradecer al gobierno del Estado de Yucatan a través de su Centro de Investigación Científica (CICY) y en particular al Dr. Germán Carnevali Fernández-Concha y María Silvia Hernández Aguilar por apoyo administrativo con las muestras de las plantas recolectadas durante las actividades de campo, y a José Luis Tapia Muñoz por su apoyo técnico en la identificación de las plantas. Por último agradezco todo el amor y apoyo que la familia Inurreta me ha dado durante mi estancia en Yucatán, y en particular a Armando y Linda por hacer las correcciones en español en la edición de este libro.
Introducción

Llegué a Tabí, Yucatán, a principios de abril 2007 para hacer un proyecto sobre la distribución del conocimiento de las plantas medicinales del pueblo. Desarrollé el proyecto porque es un tema que me interesa, y fue necesario para mi hacer un proyecto para terminar mi carrera en antropología social. Estoy estudiando esta carrera en la Universidad de Florida, en los Estados Unidos. En febrero de 2006 visité 8 comunidades pequeñas de Yucatán buscando un lugar donde poder realizar mi proyecto. Solo la gente con quien hable en Tabí y una comunidad más me dijeron que siguen usando plantas medicinales. Elegí hacer el proyecto en Tabí porque es una comunidad pequeña que todavía tiene una tradición de uso de plantas medicinales.

Este es un libro de recetas de remedios caseros hechos con plantas medicinales. Había dos propósitos para hacer el libro. El primer propósito fue que este sea un regalo a la gente de Tabí por haberme abierto sus casas y brindado toda su ayuda a mi proyecto. Sin sus respuestas a mis preguntas, su ayuda recogiendo plantas, y su tolerancia de mis observaciones de sus actividades nunca podría haber realizado este proyecto. Siento mucho agradecimiento a la gente de Tabí y ojalá que este libro ayude a mostrar mis sentimientos a ellos. El segundo propósito fue que el libro proporcione valor y renueve el interés a curar enfermedades con plantas medicinales a los jóvenes y recién casados. Mucha gente me dijo que los jóvenes y recién casados tienen menos interés en el uso de plantas medicinales que el que sus padres y abuelos tuvieron cuando eran jóvenes.

Para realizar este libro hubo varios pasos que tuve que realizar. El primer paso fue preguntar a la gente “¿Qué remedios de yerbas medicinales sabe usted?”. Pregunté a 40 personas de varias edades, sexos, religiones, y que viven en varias locaciones en el pueblo. Las respuestas de las preguntas mostraron que algunas personas sabían muchos remedios, siendo que la mayor cantidad de remedios que una persona sabía era de 88. Los resultados también mostraron que otras personas no sabían mucho, siendo que la menor cantidad de remedios una persona sabía era de 2. En total la gente a la cual le pregunté me dijeron de 659 remedios distintos de plantas medicinales. De los 659 remedios, elegí los 67 remedios que 2 o más personas mencionaron para incluir en este libro. El máximo número de personas que sabían un remedio fue de 20, la mitad de las personas entrevisté.

Después de elegir los 67 remedios más comunes, Guadalupe Chan Poot y Layda Chan Ku, mis asistentes, entrevistaron a varias personas en Tabí, incluyendo Doña Belen Poot Cuxim, Don Florencio Poot May, Doña Teodora Poot Cuxim, Doña Rosa Pech Sarabia, Doña Rosa Dorantes Gamboa, Doña Faustina Canche Chan, y Doña Natalia Matu Canche, acerca de los detalles de los remedios. Preguntaron que parte de la planta era utilizada, que medida de la parte de la planta esta utilizada, como se prepara el remedio, y cuantas veces alguien debe usarlo por día y por cuantos días seguidos.

El próximo paso fue que Layda, Guadalupe, y yo fuimos con varias personas, incluyendo a Doña Rosa Pech Sarabia, Doña Teodora Poot Cuxim, Doña Eloisa Canche Chan, Doña Felipa de Jesús Cetz Pech, Doña Marta Patron Pech, y Don Alejandro Cetz Canche, a buscar las plantas utilizadas en los remedios. Tomamos fotos de cada planta entera, de las hojas, de los frutos y las flores (si había), y a veces de la cáscara. También recogimos muestras de cada planta. El registro
de estas se realizó aplastando las plantas entre periódico y posteriormente los lleve al Centro de
Investigación Científica de Yucatán (CICY) en Mérida donde seque las plantas en una secadora
grande. Posteriormente un técnico identificó las plantas con el nombre científico. El nombre
científico es el nombre de las plantas en latín y esta reconocido por los científicos en todo el
mundo. El nombre científico de cada planta esta incluido con cada receta en el libro.

Posteriormente junté las respuestas de cada persona, de cada receta y busqué los
patrones. Las recetas en el libro son compilaciones de las recetas que cada persona nos dijo.
Había bastante variación en algunas recetas entonces a veces puse mas que una manera en como
se puede preparar el remedio. Después Guadalupe y Layda tradujeron las recetas a maya.

El libro tiene un contenido en el principio en el que dice en que pagina se puede
encontrar cada remedio. Luego en cada hoja del libro ustedes van encontrar los detalles de cada
receta, siendo en el lado izquierdo en español y maya. En el lado derecha van estar las fotos de
las plantas que están en las recetas. Al final del libro se encuentran tres índices organizado por el
nombre común y el nombre científico de las plantas, y por enfermedades. El propósito de los
índices es para que se pueda encontrar los remedios que les interesa de una manera más fácil.

**ADVERTENCIA:** Este libro fue realizado para enseñar acerca de plantas medicinales comunes
utilizadas en Tabí. La información esta presentada solo para USO EDUCATIVO. Su propósito
no es para tratar o curar enfermedades. Por favor consulta un curandero o persona con
conocimiento sobre el remedio que le interesa utilizar antes de usarlo.
U Kajbal

Uulen wey Tabi, Yucatán, tu kajbal u mesil abril tiete jaabil 2007 u tialla in mentik un p’el meyaj yoolal dieu bamboo 80 moran u sinwinchet yetel u k’abebel ten u tialla in mentik un p’el proyectu u tialla in toksik in xok tii antropología social. Tin xokik le xokaa tii u Universidad Florida, tii los Estados Unidos. Tii febrero tu jaabil 2007 tin ximbataj 8 un p elal mejen kajoob tii Yucatán tumen tan in kaxtik un p’el kuchil taux ju beytal in mentik in proyectu. Chen le makoob maax tanajen wey Tabi yetel un p’el chan kaj tialloob ten dekoskes wey kajee xulo ku meyajtaal le tzakankil xiwoobo. Tin yejay Tabi u tialla in mentik in proyectu tumen chichan u kajel yetel tumen leyliy san u tradición ti u meyajek le tzakankil xiwoobo.

Lelaa un p’el libro ti tzakoo mentaan yetel tzakankil xiwo. Yan kaachi kaap’el proposito u tialla in mentik le tzibil juunaa. Le yax proposito u tialla in siik tiee makoob kajanoob wey Tabi tumen tu jeeoo ten u jool yotochoo yetel tumen tu yanteno in proyectu. Wa muu nuujoob in t’an, mix u yantkenoo mool xiwoobo yetel u tolerancia tii in pakat yoolal meyajaa maak tuj beytal in mentik in proyectu. Kin muuyajik abaa dosbootik tie makoob wey Tabi yetel ojala le tzibil juuna u yaant u yeexik in yakunaj tii leetoob. U kamp’el proposito u tialla u tiki valor yetel interes u tialla u tzakal k’ojaani mentaan yetel le tzakankil xiwo u tankelen palaloob yetel le tantu tzooklu belooobo. Y aab makoob tialloob ten dekoskes le tankelen palaloob u tante tzooklu belooobo minaana interes tioob yoolal tzakankil xiwooboo ku mayajik tii u tataooy yetel u chichoq kaach tankelen palaloob.

U tialla u beytal in mentik le tzibil juunaa yaa baaloo anchaj in mentik. Yan baa tin mentaj, tin k’ataj tie makooboo baax tzak ku tzakik le tzakankil xiwoob yojel. Tin k’ataj ti 40 makoob tii jejeslisil u jaabilo, seyos, religiones, kajanoob tii jejeslisil tiee kaaja. Le nuuko tii in k’at chit u yeexoo decoskes un tuul makce yaab tzak yetel tzakankil xiwoob yojel, u maas yaaobl tzakankil xiw yojel de 0.88. Le nuk tazoo tissaj decoske yan makee maa yaab tzakankil xiw u yojel u maa p’it u yojel chen k’aap’el. U jaay yaaobl le tzak tiallooo tennoo 659 u jejeslisil tzakankil xiw. Tie 659 tzakoo tiallooo tennoo tin yejay 67 tzakoo tiallooo ten kaaatu wa mas mako u tiall u tiki tizibil juuna. U mas yaaobl makooy u yojoo un p’el tzak chen 20, u tanchumuk tii le maxoo tin k’at chuitoobo.

Le ku tzooklin yeel le 67 tzakoo suk u meyaj tiooboo, Guadalupe Chan Poot yetel Layda Chan Ku, inx amej jajooob tu k’at chitajooob yaabach makoob tii Tabi, Doña Belen Poot Cuxim, Don Florencio Poot May, Doña Teodora Poot Cuxim, Doña Rosa Pech Sarabia, Doña Rosa Dorantes Gamboa, Doña Faustina Canche Chan, yetel Doña Natalia Matu Canche. Yooolal tzakooobo. Tu k’ataaob baax ku meyaj tioob tiu le tzakankil xiwoob, bukaaj ku meyaj tioob, bix u mak’antaal le tzakoo yetel jay ten ku meyaj tioob tu in p’el k’an yetel mantatz jaay’el k’iin.

U laa baal tek mentaj, Layda, Guadalupe yetel ten vinnooy yetel jejeslis makoob, Doña Rosa Pech Sarabia, Doña Teodora Poot Cuxim, Doña Eloisa Canche Chan, Doña Felipa de Jesus Cetz Pech, Doña Marta Patron Pech, y Don Alejandro Cetz Canche, u tankal kaxtik le xiwoob ku meyaj tiu le tzakoo. Tek ch’iay u yeche tii le xiwooboo tulistakoo, u lee, u yeex yetel u lool (wa yantti), yan k’inee tak u sool. Tek molay u yeesejil tii jyun p’el xiw. U yeesejil le xiwoobo tek pech’a yetel prensa tak yetel periodico, le ku tzokle kaa tin bisaj tii un p’el Centro de
Investigación Científica tii Yucatán (ICY) tii Joo tuux tin tikinkunta tii un p’el nojoch tikinkunual baal. Le ku tzokle un tuul téchnico tu k’oataj le xiwoobo yetel un p’el k’abaa ku yaalaal ti k’abaa científico. Le k’abaa científico u k’abaa le xiwoob ich latin yetel k’aalaan mene kaana naatooboo tii tu lakal le yok’ol kabaa. Le k’abaa científico tii ju jun p’el al le xiwooboo tzaan tii ju jun p’el al le tzak tzaan tee tzibil juunaa.

Tin laj molaj le nuk t’an tin mentaj tii ju juntul maak, tii ju jun p’el tzak yetel tin kaxtaj u u jelaanil ichiloob. Le tzak yan tiel tzibil juunaa u nuk le tzak tiaalaj ju jun tul maak. Yan kaachi yaabach u jelaani ichele le tzakoobaa leoolal yan k’inen tin tzaj mas tii un p’el forma biix u mak antaal le tzakoo. Le ku tzookle Guadalupe yetel Layda tu tzitoob le tzakoob ich maya.

Tii kajbal le tzibil juunaa yan un p’el tzibil tuux ku yeesik tech tii makamak waal kana kaxt le tzakooob. Tii ju jun p’el wal yan a kaxtik yetel yan a wilik u tzibil le ju jun p’el tzakoo, tii un tzel u tzik ich español yetel maya. Tu tzel u nooj tii kana wil u yochele le xiwoob yan tee tzakooboo. Tu xul le tzibil juunaa yan a kaxtik exp’el indices tzolaantakoob tii u k’abaa, u k’abaa científico yetel ich k’ojaanilooob. Le indiceoo u tiaal u seteul a kaxtik le tzakoob ustaf anoo.

U NUUK: Le tzibil juunaa mentaam u tiaal u kaansaj yoolale tzakankil xiwoob ku mas meyaj wey Tabi. Le tzibil juunaa u tiaal u yeessaj chen tii u meyaj u tiaal kambal. Maa u tiaal a tzakik k’ojaanilooobii. Waa a k’aat a tzak un p’el k’ojaanil tanil k’aabet a bin inaal u tuul tzmeak yaa tii xiw u tiaal u beytal u meyaj tech.
Enfermedad cura: aire en el estómago.
Nombre común de la planta: Cebollina
Familia: Liliaceae
Nombre científica: Allium schoenoprasum L.

Parte de la planta utilizada: las hojas o la cebollita

Medida de la parte de la planta utilizada: 9 hojas o 1 cebollita

Como se prepara el remedio:
1.) Se tuestan las hojas o la cebollita.
   Después se frota las hojas entre las manos
   y se exprime en la barriga. Dá un ligero
   masaje con las hojas 9 veces.
2.) Se tuestan las hojas o la cebollita y se
   pone en el estómago.

Cantidad de veces a utilizar: una vez por
día por 2 días seguidos

K'oj'anil tzak: yik'al nak'
U k'aaba u xiw: Cebollina

Baax ku meyaj ti le tzakankil xiwo: u lee
wa u cebollai

Bukaaj ku meyaj ti le tzakankil xiwo: 9 u
lee wa 1 chan cebollai

Bix u nak'anta le tzaco:
1.) Ka pokik le ku tzokle ka jaxlik yetel ka
    yetzik ta nak'. Ka chan y et'ik yetel le 9
    leoboo
2.) Ka pokik u lee wa u cebollai le ka tzokle
    ka tzik 'a nak'.

Jay teu ku meyaj ti: un pak un p'el k'in
mantatz kaap'el k'in
Enfermedad cura: aire en el estómago
Nombre común de la planta: Naranja Agría
Familia: Rutaceae
Nombre científica: *Citrus aurantium* L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
4-6 hojas

Cómo se prepara el remedio: Se sancocha en medio litro de agua y también se le agrega un poco de bicarbonato o bolita de ceniza (solo lo que esta embalado). Se deja hervir. Luego se suspende y se deja enfriar. Finalmente se toma.

Cantidad de veces a utilizar: Se toma a cada rato hasta gastarlo. Tomar dos días seguidos.

Recomendación: No se toma agua fría o helada.

K’oja’anil tzak: yik’al nak’
U k’aaba u xiw: Pak’al

Baux ku meyaj ti le tzakankil xiwo: u lee

Bukaaj ku meyaj ti le tzakankil xiwo: 4-6 u lee

Bix u nak’anual le tzacoo: Ka chakik ichil tanchumuk litro jaa, yetel ka tziik un p’it bicarbonato ichil wa un p’él chan wolis taan. Ka p’atik lok, ka chuyik yetel ka p’atik sistal. Le ku tzakle ka wuk’ik

Jay teu ku meyaj ti: Ka wuk’ik la lah hora hasta ken u xupe. Ka wuk’ik mantatz kaap’el k’ín.

U nuuk: Maa tan a wuk’ jaa sis.

El árbol de Naranja Agría
U chei’ Pak’al

El fruto y las hojas de Naranja Agría
U yich yetel u lee Pak’al
Enfermedad cura: asma
Nombre común de la planta: Tz’intaman
Familia: Malvaceae
Nombre científico: Gossypium hirsutum L.
Parte de la planta utilizada: las hojas
Medida de la planta utilizada:
1.) 1 hoja, 2.) 4 hojas, o 3.) un puñlo de hojas

Como se prepara el remedio:
1.) Se cuecen las hojas en el comal. Exprímes el jugo en la mitad de una eucharatida y lo disuelves con media eucharatida de agua caliente. Después lo tomás.
2.) Se mueven las hojas y se frien con cebta. Después se baña al niño con lo remecido por las noches.
3.) Se canela las hojas en un litro de agua. Se le agrega miel al gusto. Luego se toma alcohólico.

Cuantidad de veces a utilizar:
1.) Lo puede tomar 2 días seguidos
2.) Lo puede usar 3 días seguidos
3.) Lo puede usar a cada rato

K’oja’anil tzak: k’ak’ as en
U k’aaba u xiw: Tz’intaman

Baax ku meyaj ti le tzakanik xiwo: u lec
Bukaaj ku meyaj ti le tzakanik xiwo:
1.) 1 u lec, 2.) 4 u lec, 3.) 1 w’ool k’ab

Bix u nak’anial le tzacon:
1.) Ka pokik u lec tii un p’el xamach. Ka yetzak u k’aab ichil tsanumuk loop le ku tzokle ka xaak tik ichil tsanumuk loop ehoko jaa. Le ku tzokle ka wuk’ik.
2.) Ka jucli’ik yetel ka tsajik yetel cebó. Le ku tzokle ka wichintik le pual yetello le kent a wil mikaah ak’atol.
Enfermedad cura: biichos  
Nombre común de la planta: Apazote  
Familia: Chenopodiaceae  
Nombre científico: Chenopodium ambrosioides L.

Parte de la planta utilizada: las hojas o la raíz

Medida de la parte de la planta utilizada:  
6-10 hojas o 5 cm. de raíz

Como se prepara el remedio: Se sancochan las hojas o la raíz en un medio litro de agua y se deja hervir. Luego se suspende y se deja enfriar. Cuando este tibiecio se toma.

Cantidad de veces a utilizar: Se toma como se toma un suero. Se puede tomar durante 2 días seguidos.

Recomendaciones: No tomar agua fría ni agua cruda. Tampoco ingerir medicamentos que contengan químicos cuando se está utilizando este remedio.

K'oja’anil tzak: u yik’el u nak’ mak  
U k’aabá u xiv: Apazote

Baax ku meyaj ti le tzakankil xivo: u lee wa u motz

Bukaaj ku meyaj ti le tzakankil xivo: 6-10 u lee wa 5 cm. u motz

Bix u mak’anta le tzaco: Ku chaacal u lee wa u motz yetel tanchamuc litro jaa, ku chaahal u lok. le ku tzokle ka luusik teo k’ak’o, yetel yan a chaik u sistaal. Le ken p’atak chen chan luumuk’ (k’ina) ka wuk’ik.

Jay teu ku meyaj ti: Ka wuk’ik jeesh u yuuk’ul suero. Ju beytal a wuk’ik mantatz kaap’el k’iin.
Enfermedad cura: bichos
Nombre común de la planta: Apazote y Hierbabuena
Familia: Chenopodiaceae y Lamiales
Nombre científico: Chenopodium ambrosioides L. y Mentha x piperita L.

Parte de la planta utilizada: la raíz o las hojas

Medida de la parte de la planta utilizada:
1) 5-7 cm. de raíz de cada planta
2) 10 hojas de cada planta

Cómo se prepara el remedio:
1) Se machaca la raíz. Luego se sanocha en 1 litro de agua hasta que hierva. Después se suspende y se deja enfriar. Finalmente se toma.
2) Se sanocha la hoja en un pote con agua.

Cantidad de veces a utilizar: Se toma como suero. Se toma hasta 2 días seguidos pero si no se cura a dentro de 2 días se suspende su uso.

K'oja'anil tzak: u yik'el u nak' mak
U k'aaba u xiw: Apazote yetel Hierbabuena

Baax ku meyaj ti le tzakankil xiwo: U lee wa u motz

Bukaaj ku meyaj ti le tzakankil xiwo:
1) 5-7 cm. u motz ti u kaap'ela
2) 10 un p'elal u lee ti tu kaap'ela

Bix u mak'anta le tzaco:
1) Ka puch'ik u motz. Le ku tzooke ka chakik yetel un p'el litro jau lasta u lok. Le ku tzoke ka lausik te k'ak' o, ka chaaik u sistal. Le ken tzooke ka wuk'ik.
2) Ka chakik u leee yetel un p'el pote jau.

Jay ten ku meyaj ti: Ka wik'ik jeeshu yuk'ul suero. Ka wuk'ik kaap'el k'in. Waa ma wutztal ka shulik a wuikik.
Enfermedad cura: bichos
Nombre común de las plantas:
Hierbabuena
Familia: Lamiaceae
Nombre científico: Mentha x piperita L.
Parte de la planta utilizada: la raíz
Medida de la planta utilizada: 5 cm. de raíz

Como se prepara el remedio: Se machaca la raíz y se sancocha en medio litro de agua. Cuando esto esté se toma.

Cantidad de veces a utilizar: Se toma por eucharaditas a cada rato.

La hierba de Hierbabuena
U xiw Hierbabuena

Las hojas de Hierbabuena
U lea Hierbabuena

K'oj'anil tzak: u yik'el u nak' mak
U k'aba u xiw: Hierbabuena

Baax ku meyaj ti le tzakanik xiwo: u motz

Bukanaj ku meyaj ti le tzakanik xiwo: 5 cm. u motz

Bix u nak'antaal le tzacoq: Ka puch'ik le ku tzokle ka chakik ie'nil tanchumuk litro jaa. Le ken p'atak chea chan k'inal ka wuk'ik.

Jay teu ku meyaj ti: Ka wuk'ik mejen loop la lah hora.
Enfermedad cura: caída del cabello  
Nombre común de la planta: Sábila  
Familia: Liliaceae  
Nombre científica: Aloe vera (L.) Barm. f.  

Parte de la planta utilizada: Las hojas  
Medida de la parte de la planta utilizada: 1 hoja  
Como se prepara el remedio: Se corta 1 hoja y quitan el gel. Se mezcla el gel en un litro de agua. Después se lava el cabello con el remedio.  
Cantidad de veces a utilizar: Lo puede usar todos los días.

K'oja'amil tzak: lubul tzotzel pool  
U k'aaba u xiwi: Sábila  

Baax ku meyaj ti le tzakankil xiwo: u lee  
Bukaaj ku meyaj ti le tzakankil xiwo: 1 u lee  

Bix u mak'anta le tzaco: Ka xeolik un p'el u leet le ku tzokle ka luusik u noy. Ka yuaach'tik u noy ichil un p'el litro jai. Le ku tzokle ka p'oil u tzotzel a pool yatel.  

Jay ten ku meyaj ti: Ku beytal u meyaj tech sansamal.
Enfermedad cura: calentura
Nombre común de la planta: Café y X-K’o’och
Familia: Rubiaceae y Euphorbiaceae
Nombre científico: Coffea arabica L. y Ricinus communis L.

Parte de la planta utilizada: las hojas de X-K’o’och y los granos de Café

Medida de la parte de la planta utilizada: la cantidad que sea necesaria para cubrir sus pies

Como se prepara el remedio: Se le pone vaporrub a las hojas. Luego se le agrega el Café. Después se tapan los pies con el remedio. Después se amarran los pies con tela, para que no se caigan las hojas.

Cantidad de veces a utilizar: Si se lo pone en la mañana se lo quita en la tarde antes de que se duerma y si se lo pone en la tarde se lo quita al día siguiente. Usarlo hasta que se quite la calentura.

K’oja’anil tzak: chokuil
U k’aaba u xiw: Café yetel X-K’o’och

Baaax ku meyaj ti le tzakanxil xiwo: u lee x-k’o’och yetel eafé

Bukaaj ku meyaj ti le tzakanxil xiwo: le buenah ku beyal u lah tep ka wok

Bix u mat’aama le tzaco: Ku choobel vaporrub yetel eafé tu tan u leel x-k’o’och, le ku tzokle ka tep ka wok yetel, le ka tzokle ka k’asik yetel un shet’ nok’ u tial mu lubul u lee le X-K’o’och.

Jay teu ku meyaj ti: Wa ku tzaba tu sasal k’in yu x’uch ka yel u yil tu bìn k’in antes u ch’ital wene, wa ku tzik tu bìn k’in yu x’unik tu sasal u jel k’in. Yan u xulu u meyaj tech le ken a wil tzawatzal.
Enfermedad cura: calentura en el estómago
Nombre común de la planta: Llantén
Familia: Plantaginaceae
Nombre científica: Plantago major L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada: 6-9 hojas o 3 hojas para bebés de 1 o 2 semanas

Como se prepara el remedio: Se sancochan las hojas en medio litro de agua (o un pote para bebés recien recidos) y se deja hervir. Se suspender y cuando este frío se toma.

Cantidad de veces a utilizar: Se toma en lugar de agua.

K’oja’anil tzak: chokual nak’
U k’aab’ u xiv: Llantén

Baax ku meyaj ti le tzakankil xivo: u lee

Bukaaj ku meyaj ti le tzakankil xivo: 6-9 u lee wa 3 u lee u t’aal chambal yan tioob 1 wa 2 semana tioob.

Bix u nak’anaaal le tzaco: Ka chakik u lee ichil tanchumuk litro jaa (va ichil un p’el pote jaa u t’aal mejen chambal) ka chakik u lok le ku tzoko ka ch’uyik. Le ken sisakee ku yuuk’u.

Jay ten ku meyaj ti: Ku yuuk’u jeex u yuuk’u jaa.
Enfermedad cura: caspa en el cabello
Nombre común de la planta: Sábila
Familia: Liliaceae
Nombre científica: Aloe vera (L.) Barm. f.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
1-3 hojas

Como se prepara el remedio:
1.) Se corta a la mitad y se saca el gel. Mezcla el gel con un jabón de lavado y lava el pelo con la mezcla.
2.) Se pela la hoja y se saca el gel. Se maestra en un cubo con agua y después lava su cabello con la mezcla.

Cantidad de veces a utilizar: Lo puede usar todos los días o las veces que quiera.

K'oj'anil tzak: caspa
U k'aaba u xiw: Sábila

Baux ku meyaj ti le tzakankil xiwo: u lee

Bukaaj ku meyaj ti le tzakankil xiwo: un 1-3 u lee

Bix u nak'antaal le tzacoo:
1.) Ka xotik (wa ka bujik) tu tanchuyuk, yetel ka joosik u noy le ku tzokle ka xaxakit yetel un p'el jaboni p'oo le ku tzokle ka p'ok u tzootzal a pool yetel.
2.) Ka susik u lee yetel ka joosik u noy. Ka yaach'ik iehil un p'el ch'oy jia le ku tzokle ka p'ok u tzootzal a pool yetel.

Jay teu ku meyaj ti: Ku beytal u meyaj tech tu lakal k'in wa le jaipak a k'at.
Enfermedad cura: cólico
Nombre común de la planta: Naranja Agria
Familia: Rutaceae
Nombre científica: Citrus aurantium L.

Parte de la planta utilizada: la raíz o las hojas

Medida de la parte de la planta utilizada:
Sem de raíz o 4-9 hojas

Cómo se prepara el remedio:
1.) Se sancoche la raíz en un pozo con agua y se deja hervir. Cuando el agua llegue a la mitad del pozo se suspende y se toma tibiamente.
2.) Se nastruigan las hojas en un vaso con agua y le agregas un poco de bicarbonato. Luego se cuece y se toma.

Cantidad de veces a utilizar: solo una vez al día

K'oha'anil tzak: ch'i'j nak
U k'aab u xiv: Pak'al

Baax ku meyaj ti le tzakankil xiwo: u motz wa u lee

Bukaaj ku meyaj ti le tzakankil xiwo: 5 cm. u motz wa 4-9 u lee

Bix u nak'ana le tzaco:
1.) Ka chakik u motz ichil un p'el pote jaa yetel ka p'atik lok. Le ken a vil tzu nakal tanchumuk potle ka ch uyik, le ken p'atik chen chan k'in ka wuk'ik.
2.) Ka vaach'ik u lee ichil un p'el vaso jaa yetel ka tzik un p'it bicarbonano ichil. Le ku tzokle ka mayik yetel ka wuk'ik.

Jay ten ku meyaj ti: chen un pak un p'el k'in
**Enfermedad cura:** cólico  
**Nombre común de la planta:** Ortiga  
**Familia:** Urticaceae  
**Nombre científico:** Urena baccifera (L.) Gaudich. ex Wedd.

**Parte de la planta utilizada:** las hojas

**Medida de la parte de la planta utilizada:**  
1.) 2 hojas o 2-3) 9 hojas o un puño

**Cómo se prepara el remedio:**  
1.) Le untas las 2 hojas en la parte que duele.  
2.) Se sancochan las hojas en un litro de agua y luego se toma.  
3.) Tuestas las hojas en el comal y frota las hojas entre las manos. Después las mezclas en 3 cucharadas con agua. Luego se toma.

**Cantidad de veces a utilizar:** a cada rato  
por 2 días seguidos

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**K’oja’anil tzak:** chi’ot nak’  
**U k’aaba u xiv:** Laal

**Baax ku meyaj ti le tzakank’il xivo:** u lee

**Bukaaj ku meyaj ti le tzakank’il xivo:**  
1.) 2 u lee o 2-3.) 9 u lee wa 1 woo’l k’ab

**Bix u makan’atael le tzaco:**  
1.) Ka chokik u lee le tuex yaj techoo.  
2.) Ka chahik u lee iehil un p’el litro jaa le ku tzokle ka wak’ik.  
3.) Ka pokik u lee tii yu p’el xamach le ku tzokle ka jaxlik. Le ku tzokle ka xaak’tik yetel ex’el loop jaa la ku tzokle ka wuk’ik.

**Jay teu ku meyaj ti:** la lah hora mantatz.  
**kaap’el k’in**
Enfermedad cura: comezón
Nombre común de la planta: K’ulinsiis
Familia: Meliaceae
Nombre científico: Trichilia hirta L.

Parte de la planta utilizada: la cáscara o las hojas

Medida de la parte de la planta utilizada: 2 pedazos de 7 cm. de cáscara o medio bulto de hojas

Cómo se prepara el remedio: Se sancocha la cáscara o las hojas en medio litro de agua. Luego se baña cuando está tibieento el remedio.

Cantidad de veces a utilizar: Lo puede bañar durante 2 días seguidos.

Recomendación: No va a salir para que lo ventile el viento.

K’oja’anil tzak: sasak’ winkila
U k’aaba u xiw: K’ulinsiis

Baax ku meyaj ti le tzakankil xiwo: u sóol wa u lee

Bukaaj ku meyaj ti le tzakankil xiwo: 2 xot’ de 7 cm. wa un p’el bulto u lee

Bix u mak’antaal le tzacoo: Ka chakik ichil tanchumuk litro jaa. Le ken p’atak chen chan k’inal ka viehntik.

Jay teu ku meyaj ti: Ju beytal a viehntik mantatz kaap’el k’im.

U nuuk: Maa la jok’o tankaa u tiaal muu pikkech ik’.

El árbol de K’ulinsiis
U che’ K’ulinsiis

Las hojas de K’ulinsiis
U lee K’ulinsiis

La cáscara de K’ulinsiis
U sóol K’ulinsiis
Enfermedad cura: cuando se seca la leche de una mamá
Nombre común de la planta: Chaya
Familia: Euphorbiaceae
Nombre científico: Cnidoscolus aconitifolius (Mill.) I.M. Johnston

Parte de la planta utilizada: las hojas

Medida de la planta utilizada: 10 hojas

Como se prepara el remedio: Se sazonan las hojas en medio o un litro de agua y después se torna.

Cantidad de veces a utilizar: a cada rato en dos días seguidos

K'oj'anil tzak: wa minan u k'ah u yim un tul kold yu Chambal
U k'aaba u xiw: Chay

Bax ku meyaj ti le tkakanik xiwo: u lec

Bukaaj ku meyaj ti le tkakanik xiwo: 10 u lec

Bix u mak'antaal le tzaco: Ka chakik ichi háchumuk litro jaa le ku tzokle ka wuk'ik

Jay ten ku meyaj ti: la lah hora mantatz kaap'el k'in
**Enfermedad cura:** cuando se seca la leche de una mamá
**Nombre común de la planta:** Naranja Agria
**Familia:** Rutaceae
**Nombre científica:** Citrus aurantium L.

**Parte de la planta utilizada:** las hojas

**Medida de la planta utilizada:** un paño

**Cómo se prepara el remedio:** Se sancochan las hojas en medio cubo con agua. Luego se baña y pone las hojas en su pecho.

**Cantidad de veces a utilizar:** solo una vez

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**K'oja'anil tzak:** wa minan u k'ab u yim un tul kold yan u chambal
**U k'aaba u xiw:** Pak'al

**Baax ku meyaj ti le tzakanik xiwo:** u lec

**Bukaaj ku meyaj ti le tzakanik xiwo:** un wōol k'ab

**Bix u mak'antaal le tzacoo:** Ka chakik u lee ichil tanchumuk ch'oy jaa. Le ku tzokle ka wihintik yetel ka tzik u lee ta wim.

**Jay ten ku meyaj ti:** chen un pak
**Enfermedad cura:** diabetes  
**Nombre común de la planta:** K’an Lool  
**Familia:** Bignoniaceae  
**Nombre científico:** Tecoma stans (L.) Juss. ex. Kunth

**Parte de la planta utilizada:** las hojas

**Medida de la parte de la planta utilizada:** 1 vara o 1 puño

**Como se prepara el remedio:** Se sancocchan las hojas en medio litro de agua, y se deja hervir. Después se suspende y se toma.

**Cantidad de veces a utilizar:** Se toma 3 veces al día, todos los días.

**K’oja’ant il tzak:** ch’uyuk wix  
**U k’aab u xiw:** K’an Lool

**Baax ku meyay ti le tzakankil xiwo:** u lee

**Buukaaj ku meyay ti le tzakankil xiwo:** 1 xot’, wa 1 wóol k’ab

**Bix u mak’ani le tzaco:** Ka chakik u lee ichil tanchumuk litro jaa, le ken loknak ka ch’uyik, le ku zokle ka wuk’ik.

**Jay ten ku meyay ti:** Ka wuk’ik oxten tu lakal k’in.
Enfermedad cura: diabetes
Nombre común de la planta: Naranja Agria
Familia: Rutaceae
Nombre científica: Citrus aurantium L.

Parte de la planta utilizada: el fruto

Medida de la parte de la planta utilizada:
1-2 frutos

Como se prepara el remedio: Chupas los frutos.

Cantidad de veces a utilizar: todos los días

K'ox' anil tzak: eh'uj g'ix
U k'aaba u xiv: Pak'al

Baaax ku meyaj ti le tzakankil xixo: u yich

Bukaaj ku meyaj ti le tzakankil xixo: 1-2 u yich

Bix u mak'an a le tzaco: Ka chuuchik u k'ab.

Jay ten ku meyaj ti: tu lakal k'in
Enfermedad cura: diarrea
Nombre común de la planta: Claudiosa, Kabalpixoy, y Nema’ax
Familia: Serphulariaceae, Malvaceae, y Boraginaceae
Nombre científica: *Capparidium bicalcaratum*,
*Malvastrum cromandellianum* (L.) Careke,
y *Heliotropium angiospermum* Murray

Parte de la planta utilizada: la raíz de cada planta

Medida de la planta utilizada: las raíces de 9 plantas de Claudiosa y Nema’ax, y las raíces de 2 plantas de Kabalpixoy

Como se prepara el remedio: Se sanguchan las raíces en un litro de agua y se deja hervir. Cuando el agua llegue en medio litro se suspende, se deja enfriar, y se aplica en lavados.

Cantidad de veces a utilizar: solo una vez

K’oja' anil tk: wach’ k’aja
U k’a‘a ba u xiw: Claudiosa, Kabalpixoy, yetel Nema’ax

Baax ku meyaj ti le tzakankil xiwu: u motz

Bukauj ku meyaj ti le tzakankil xiwu: u motz 9 u chei Claudiosa yetel Nema’ax, yetel u motz 2 u chei kabalpixoy


Jay teu ku meyaj ti: ehen un pak

La hierba de Claudiosa
U xiv Claudiosa

Las hojas y las flores de Claudiosa
U lee yetel u lool Claudiosa

El arbusto de Kabalpixoy
U che’ ma’ tu jian kimil Kabalpixoy
Enfermedad cura: diarrea
Nombre común de la planta: Ciruela (Ek abal y Tuzpana)
Familia: Anacardiaceae
Nombre científica: Spondias purpurea L.

Parte de la planta utilizada: la cáscara o corteza

Medida de la parte de la planta utilizada:
1.) 30 gramos, 2.) 3 pedazos de 5 cm., o 3.) 2 pedazos de 5 cm.

Como se prepara el remedio:
1.) Se sanocha la cáscara en medio litro de agua y se endulza al gusto. Después te lo tomas tibiecto.
2.) Se sanocha la cáscara en un litro de agua y se da en lavado.
3.) Se remoja la cáscara en un pote con agua todo el día. Luego se toma.

Cantidad de veces a utilizar: Tómalo a cada rato por 2 días seguidos.

K’oja’ unil tzak: wah’ k’a’ja
U k’a’baa u xiw: Abal (Ek abal y Tuzpana)

Baax ku meyaj ti le tzakankil xiwo: u xot wa u sóol

Bukaaj ku meyaj ti le tzakaankil xiwo:
1.) 30 gramos, 2.) 3 xot’ de 5 cm., wa 3.) 2 xot’ de 5 cm.

Bix u muk’ana le tzaco:
1.) Ka chakik ichil tanchumuk litro jaa, yetel ka ch’ik kinsik. Le ku tzokle ka wuk’ik bey k’inilico.
2.) Ka chakik u sóol ichil un p’el litre jaa, le ku tzokle ka tzik u lavados.
3.) Ka ch’ulik u sóol ichil un p’el pote jaa bul k’in. Le ku tzokle ka wuk’ik.

Jay ten ku meyaj ti: Ka wuk’ik la lah hora mantatz kaap’el k’in.
Enfermedad cura: diarrea
Nombre común de la planta: Flor de Santiago
Familia: Polygonaceae
Nombre científica: Antigonon leptopus
Hook. & Arn.

Parte de la planta utilizada: la raíz

Medida de la planta utilizada: 5 cm. de la raíz

Como se prepara el remedio: Se machaca la raíz y se sanecha en medio o un litro de agua. Se da en lavado o se toma.

Cantidad de veces a utilizar: Si se ca en lavado solo se hace una vez. Si la diarrea sigue después de tres días puede repetir el mismo tratamiento. De lo contrario puede tomarlo a cada rato.

K'oja'añil tzak: wash' k'aj'a
U k'aaba u xiv: Flor de Santiago

Baux ku meyaj ti le tzakankil xivo: u motz

Bukaaj ku meyaj ti le tzakaankil xivo: 5 cm. u motz

Bix u mak'amanaal le tzaco: Ka k'utik u motz yetel ka chakik ichil tanxumk wa un p'el litro jaa. Ka tzak u lavados wa ka wuk'ik.

Jay ten ku meyaj ti: Wa lavados ka a tza ka tzik chen un pak. Wa mu luq'u teh le wach'kajlo le manak oxp'el k'in ju beytal a kaa tzik u laa. Wa uk'bi kan a bete yan a wuk'ik la tah hora.
Enfermedad cura: diarrea
Nombre común de la planta: Llantén
Familia: Plantaginaceae
Nombre científica: Plantago major L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada: 2-4 hojas

Como se prepara el remedio:
1.) Se utilizan las hojas que salen en la punta del tallo. Se sacechan 2-4 hojas en un medio litro de agua hasta que hierva, se suspende, y se deja enfriar. Si quieres le agregas azúcar al gusto. Luego se toma.
2.) Se sacechan 3-4 hojas en medio litro de agua. Se deja enfriar y aplicando en lavado.

Cantidad de veces a utilizar: Se toma a cada rato como agua, durante 3 días seguidos.

K’oja’u'nil tzak: wachi’ k’aju
U ka’aab u xiv: Llantén

Baax ku meyaj ti le tzakanxil xivo: u lee
Bukaaj ku meyaj ti le tzakanxil xivo: 2-4 u lee

Bix u nak’anta le tzaco:
1.) Ka ch’ik u lee ku jok’o tu xul le n mutultsi. Ka chak’ik 2-4 u lee ichil tanchumuk litro jaa, le ken loknakeek ka ch’ik (wa ka lunsik lee k’akoo), chen wa k’at leken siskeek ka tzik un p’it az’u’cari ichil, le ku tzokle ka wuk’ik.
2.) Ka chak’ik 3-4 u lee ichil tanchumuk litro jaa. Ka p’atik sista le’ ku tzookle ka tzik u lavados.

Jay ten ku meyaj ti: Ka wuk’ik la lah hora en ves jaa, mantatz 3 k’in.
Enfermedad cura: diarrea
Nombre común de la planta: Maíz
(tortillas quemadas)
Familia: Poaceae
Nombre científico: Zea mays L.

Parte de la planta utilizada: grano

Medida de la parte de la planta utilizada:
1 tortilla

Como se prepara el remedio: Se quema y se remoja en un pote con agua. Después se eula y luego se tona.

Cantidad de veces a utilizar: Lo puede tomar a cada rato durante 2 días seguidos.

K'oja'aníl tzak: wach' k'aja
U k'aaba u xiv: Le waa e la'ano

Baax ku meyaj ti le tzakankil xiwol u yiximul

Bukaaj ku meyaj ti le tzakaankil xiwol: 1 waj

Bix u mak'anta le tzaco: Ka toik le ku tzokle ka tzamik ichil un p'el pote jaa. Le ku tzokle ka maytik yetel ka wuk'ik.

Jay ten ku meyaj ti: Ku beytal a wuk'ik la lah hora mantatz kaap'el k'in.
Enfermedad cura: diarrea  
**Nombre común de la planta:** Menta de Monte  
**Familia:** Lamiales  
**Nombre científico:** *Ocimum canescens* Mill.  

**Parte de la planta utilizada:**  
1.) la raíz, 2.-3.) las hojas, o 3.) la resina  

**Medida de la parte de la planta utilizada:**  
1.) 5 cm., 2.-3.) 1 puño, o 4.) 5 gotas  

**Cómo se prepara el remedio:**  
1.) Se machaca la raíz. Después se remoja en un pote con agua. Finalmente se toma.  
2.) Mezcle o mastruje las hojas en un litro de agua. Luego lo cuele. Finalmente lo toma.  
3.) Se sanochean las hojas en medio litro de agua y luego se toma.  
4.) Se aplica la resina en la mitad de un vaso con agua y luego se toma.  

**Cantidad de veces a utilizar:**  
1.) una vez al día  
2.-3.) A cada rato, hasta que te eures.  
4.) 4 veces al día  

**K'oja'anił tzak:** wach' k'aja  
**U k'aaba u xiw:** Kakaltún  

**Baax ku meyaj ti le tzakankik xiwo:**  
1.) u motz, 2.-3.) u lee, 4.) u yitz  

**Bukaaj ku meyaj ti le tzakankik xiwo:**  
1.) 3cm. u motz, 2.-3.) 1 wool kab u lee, yetel 4.) ch'aj  

**Bix u nak'antael le tzaco:**  
1.) Ka puch'ik u motz. Le ku tzokle ka tzamik ichil un p' el pote jaa. Le ku tzokle ka wuk'ik  
2.) Ka xak'tik wa ka yaseh'tik u lee ichil un p' el litro jaa le ku tzokle ka mayik yetel ka wuk'ik.  

3.) Ka chakik u lee ichil tanchumuk ḫtro jaa le ku tzokle ka wuk'ik.  
4.) Ka ch'ajik u yitz ichil tanchumuk vaso jaa le ku tzokle ka wuk'ik.  

**Jay ten ku meyaj ti:**  
1.) un pak un p'el k'in  
2.-3.) La lah hora hasta le ken utzakeel.  
4.) 4 ti un p'el k'in
Enfermedad cura: diarrea
Nombre común de la planta: Plátano (manzano o negro)
Familia: Musaceae
Nombre científica: *Musa x paradisiaca* L.

Parte de la planta utilizada: la resina

Medida de la planta utilizada: 1 gota para bebés de 6 meses hasta año y medio, 2 gotas para niños de 2 a 4 años, 20-30 gotas para adultos.

Como se prepara el remedio: Se grexa en media euchanita con agua para bebés, en una euchara con agua para niños, y en medio vaso de agua para adultos. Luego se toma.

Cantidad de veces a utilizar: Solo 1 vez para bebés y niños. Hasta 4 veces al día para adultos.

K’oja’anil tzak: wa’eh’ k’aja
U k’aaba u xiw: Ja’as (manzano wa box)

Baax ku meyaj ti le tzakankil xiw: u yitz

Bukaaj ku meyaj ti le tzakankil xiw: 1 ch’aj u tiall mejen chambal yan tiob 6 meses tak tanchumuk jaabil. 2 ch’aj u tiall palal yan tiob 2 wa 4 jaabil 20-30 ch’aj u tiall nukuch maak.

Bix u mak’antaal le tzaco: Ka ch’ajik ichil tanchumuk loop jaa u tiall mejen chambal, wa u tiall palal un p’el loop yetel tanchumuk vaso jaa u tiall nukuch maak.

Jay ten ku meyaj ti: Chen un pak u tiall mejen chambal yetel u tiall palal. Tak 4 u pakal ti un p’el k’in u tiall nukuch maak.
Enfermedad cura: diarrea
Nombre común de la planta: Puk’in
Familia: Verbenaceae
Nombre científica: Callicarpa acuminate
Kunth.

Parte de la planta utilizada: las hojas

Medida de la planta utilizada: 5 o 1 puño de hojas

Como se prepara el remedio: Se sancochan las hojas en medio litro de agua y luego se toma.

Cantidad de veces a utilizar: A cada rato hasta que se cure.

K'oja'anil tzak: wach’ k’aja
U k’abu u xiv: Puk’in

Baax ku meyaj ti le zkank’il xivo: u lecc
Bukaaj ku meyaj ti le tzakaak’il xivo: 5
wa 1 wóol k’ab u lecc

Bix u mak’antaal le tzaco: Ka chakik ichil tanchumuk litro jaa le ku tzokle ka wuk’ik.

Jay te’en ku meyaj ti: La lah hora tak ken utzakech.

El arbusto de Puk’in
U che’ ma’ tu jään kiimil Puk’in

La hoja y las flores de Puk’in
U lecc yetel u lool Puk’in

Los frutos de Puk’in
U yich Puk’in
Enfermedad cura: diarrea
Nombre común de la planta: Weech xiww
Familia: Euphorbiaceae
Nombre científico: Euphorbia gaumeri
Millsp.

Parte de la planta utilizada: la resina

Medida de la parte de la planta utilizada: 2 gotas

Como se prepara el remedio: Se gotea la resina en una cucharadita con agua y después se toma. También puede bañar al niño con las hojas (2 puños) mezclado en un cubo con agua.

Cantidad de veces a utilizar: a cada rato por 2 días seguidos

K'oja'anil tzak: waeh' k'ajja
U k'aaba u xiww: Weech xiww

Baax ku meyaj ti le tzakanik xiwo: u yitz
Buukanj ku meyaj ti le tzakanik xiwo: 2 ch'aj

Bix u mak'anatul le tzacoo: Ka ch'ajik ti un p'el chan joop ja le ku tzakle ka wuk'ik. Wa k'atec ju beytal a wisinsik le pal yetel kaap'el loch' u lee ka xaak'tik ichil un p'el ch'oj jaa.

Jay ten ku meyaj ti: la tah hora mantatz kaap'el k'in

El arbusto de Weech xiww
U che' ma' tu jaan kiimil Weech xiww

Las hojas de Weech xiww
U lee Weech xiww

Las hojas de Weech xiww
U lee Weech xiww

35
Enfermedad cura: diarrea
Nombre común de la planta: X-Napche'
Familia: Olacaceae
Nombre científica: Ximenia americana L.

Parte de la planta utilizada: La raíz, o la corteza o la cáscara

Medida de la parte de la planta utilizada:
1.) 10-15 cm. de raíz
2.) 2 pedazos de 5 cm. de corteza o 10 cm de raíz

Como se prepara el remedio:
1.) Primero, se pela y se lava la raíz. Después se sarcoma la raíz en medio litro de agua. Después se terma.
2.) Se sarcoma la raíz o la corteza en un litro de agua. Se da en lavados.

Cantidad de veces a utilizar:
Lo puedes tomar 3 veces al día.

K'oja'anil tzak: wach’ k’aja
U k’aabu u xiv: X-Napche’

Baax ku meyaj ti le tzakankil xiwo: u motz, u xot wa u sol

Bukaaj ku meyaj ti le tzakankil xiwo:
1.) 10-15 cm. u motz
2.) 2 u xot’ol de 5 cm wa 10 cm u motz

Bix u mak’anail le tzacooy:
1.) Tamiz ka susik, le ka tzokle ka p’esk. Ka chakik ichil tanchumuk litro jaa, le ka tzokle ka wuk’ik.
2.) Ka chakik u motz wa u paeh ichil un p’el litro jaa. Ka tzik u lavados.

Jay ten ku meyaj ti: Ku beytal a wuk’ik o xpak un p’el k’iin.
Enfermedad cura: diarrea
Nombre común de la planta: Zapote
Familia: Sapotaceae
Nombre científica: Manilkara sapota (L.) P. Royen

Parte de la planta utilizada: la cáscara o corteza que se encuentra en medio del tronco y es de color rosado

Medida de la parte de la planta utilizada: 5 cm de ancho y 10-15 cm. de largo

Cómo se prepara el remedio: Se sencoccha la cáscara en un medio litro de agua, se deja hervir, y después se suspende. Luego se deja entrar y después se tome o se da en lavado.

Cantidad de veces a utilizar: Se puede tomar las veces que quiera.

K’oja’anil tzak: waäch’ k’aja
U k’aaba u xiv: Ya’á

Baax ku meyaj ti le tzakankil xivo: u sóol wa u paach ka kaxtik lee chumuk u eheeloo u bonilee rosaló

Bukauj ku meyaj ti le tzakankil xivo: 5 cm. u cochil yetel 10-15 cm. u chokil

Bix u mak’anual le tzacol: Ka chakik ichil tachumuk litro jaa, ca chaaxik u lok, le ku tzokle ka ch’uyik. Ka p’atik sistal le ku tzokle ka wuk’ik wa ka tzik u lavados.

Jay teu ku meyaj ti: Ku beytal a wuk’ik jee jayteen a k’atee.

El árbol de Zapote
U che’ Ya’a

Las hojas de Zapote
U lee Ya’a

El fruto de Zapote
U yich Ya’a
Enfermedad cura: disentería
Nombre común de la planta: Limón País
Familia: Rutaceae
Nombre científica: Citrus limonia Osbeck
Parte de la planta utilizada: el fruto
Medida de la parte de la planta utilizada:
1.- 2.) 1 fruto o 3.) 2-3 frutos

Como se prepara el remedio:
1.) Se exprime en la mitad de un vaso con agua y luego se toma.
2.) Se exprime el jugo en medio vaso con agua y luego se mezcla con un cuarto de vaso con coca. Luego se toma.
3.) Se exprime el jugo en un vaso con coca o negra y después se toma.

Cantidad de veces a utilizar:
Puede tomarlo a cada rato por 3 días seguidos.

K'oj'anil tzak: k'ik' nak'
U k'ab'a u xiv: Limón País

Baax ku meyaj ti le tzakanik xiwo: u yieh

Bukaaj ku meyaj ti le tzakanik xiwo:
1.- 2.) 1 yieh wa 3.) 2-3 u yieh

Bix u muk'anamle tzacon:
1.) Ka yetzik ieh la tanchumuk vaso jaa, le ku tzokle ka wuk'ik.
2.) Ka yetzik ieh la tanchumuk vaso jaa, le ku tzokle ka xaan'ik yiel un cuarto vaso coca. Le ku tzokle ka wuk'ik.
3.) Ka yetzik u k'ab iehil un p'el vaso coca wa negra, le ku tzokle ka wuk'ik.

Jay teu ku meyaj ti: Ku beytal a wuk'ik la lah bora mantatz 3 k'ina.
Enfermedad cura: disentería
Nombre común de la planta: Menta de Monte
Familia: Lamiaceae
Nombre científica: Ocimum campechanum Mill.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
1.) 15 hojas (si es para lavados se utilizan 20 hojas) o 2.) 8 hojas

Cómo se prepara el remedio:
1.) Se sumerge las hojas en medio litro de agua y se dejan hervir. Después se suspende y luego se toma o administra en lavado.
2.) Se machaca o se maestran las hojas en un pote con agua. Después se cuela y se toma.

Cantidad de veces a utilizar: Se toma cada 2 horas. Si todavía tiene síntomas puede tomar al día siguiente.

K’oj’a’nîl tzak: k’ik’ nak’
U k’aaba u xiw: Kakaltún

Baax ku meyaj ti le tzakankil xiwo: u le

Bukaaj ku meyaj ti le tzakankil xiwo:
1.) 15 u le (wa u trial lavados ku meyaj tech 20 u le) wa 2.) 8 u le

Bix u mak’anta le tzaco:
1.) Ka chakik ich tanchumuk litro jaa, yan a chasik u lok. Le ku tzokle ka ch’ujik, ka wuk’ik wa ka tzik u lavados.
2.) Ka yaach’ik ichil un p’el potte jaa. Le ku tzokle ka maytik yetel ka wuk’ik.

Jay ten ku meyaj ti: Ka wuk’ik cada 2 hora. Wa mu man tech, tu laa k’in ka wuk’ik u laa.
Enfermedad cura: disentería
Nombre común de la planta: Pitajaya
Familia: Cacteae
*Nombre científico: Hylocereus undatus*
(Haw.) Britton & Rose

Parte de la planta utilizada:
1) la guía o 2) el fruto

Medida de la planta utilizada:
1) 1 tina de 20-40 cm. o 2) 1 fruto

Como se prepara el remedio:
1) Se pela la guía y se le quita el gel. Después lo mastrujas en un vaso con agua. Se le agrega azúcar al gusto. Luego se toma. 2) Se mezcla la pulpa del fruto en un poque con agua y después se toma.

Cantidad de veces a utilizar: a cada rato por 3 días seguidos

K’oja’anil tzak: k’iik’ nak’
U k’aaba u xiw: Pitajaya

Baux ku meyaj ti le tzakankil xiwo:
1) u chokil wa 2) u yeih

Bukaaj ku meyaj ti le tzakaankil xiwo:
1) 1 xot’ de 20-40 cm wa 2) 1 u yeih

Bix u mak’antaal le tzacon:
1) Ka nusik u chokil le ku tzokle ka husik u noy. Le ku tzokol ka yaach’tik ichil un p’el vaso jaa, yetel yan a tzik un p’it azúcar ichil, le ku tzokle ka wuk’ik.
2) Ka yaach’tik u noy le u yehoo ichil un p’el poje jaa le ku tzokle ka wuk’ik.

Jay ten ku meyaj ti: lai hasa mantatz 3 k’in
Enfermedad cura: disentería
Nombre común de la planta: X-Pepektun
Familia: Menispermaceae
Nombre científica: Cissampelos pareira L.

Parte de la planta utilizada: Las hojas

Medida de la parte de la planta utilizada:
Un puño

Como se prepara el remedio:
1.) Se sazonan las hojas en medio litro de agua y se dejan hervir. Luego se suspende y se toma.
2.) Se raspa y en una taza de agua se agrega azúcar al gusto. Luego lo cuele y después se toma.

Cantidad de veces a utilizar:
Si es disentería roja se toma a cada rato por 2 o 3 días seguidos. Si es otro tipo de disentería se toma hasta 2 veces al día.

K'oja'nil tzak: k'ik' nak'
U k'aaba u xiw: X-Pepektun

Baax ku meyaj ti le tzakankil xiwo: u le

Bukaaj ku meyaj ti le tzakankil xiwo: un wōol k'ab

Bix u mak'anta le tzaco:
1.) Ku chaakal u lee ich tanchumuk litro jaa, le kik loknakee, le ku tzokle ka wuk'ik.
2.) Ka yaach'ik u lee ti un p'el taza jaa le ku tzokle ka tzik an p'it az'uear ichi. Yan a maytik, le ku tzokle ka wuk'ik.

Jay ten ku meyaj ti:
Wa chak le k'ik' nak'o yan a wuk'ik la laj hom mantz kap'el wa o x'el k'in. Wa u laa yanal k'ik' nak' ka wuk'ik kaaten un p'el k'in.
**Enfermedad cura:** dolor de cabeza
**Nombre común de la planta:** Jicara
**Familia:** Bignoniaceae
**Nombre científico:** *Crescentia cujete* L.

**Parte de la planta utilizada:** Las hojas

**Medida de la parte de la planta utilizada:** 4-6 hojas

**Cómo se prepara el remedio:** Pones las hojas en tu fresco y las amarras con una tela antes de dormir.

**Cantidad de veces a utilizar:** Si se ponen en la mañana se quitan en la tarde, pero si se ponen en la tarde se quitan al día siguiente en la mañana. Usarlos hasta que se quite el dolor de cabeza.

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**K'oj'a'nil tzak:** chitkal pool
**U k'aaba u xiv:** Luuch

**Baax ku meyaj ti le tzakankil xivo:** u lee

**Bukaaj ku meyaj ti le tzakankil xivo:** 4-6 u lee

**Bix u mak'anta le tzaco:** Katzik u lee ta tan joolal le k'токle ka k'axik yetel um xet' nok' le k'en k'alaj a chitul wencel.

**Jay ten ku meyaj ti:** Wa ka tzik tu sasal k'in yan a luusik le k'en a wil tu bin k'in. Wa ka tzik tu bin k'in yan a luusik tu jel k'in (tu sasal k'in). Yaan u mejay teh hassa le k'en manak teh le k'inan pool.
Enfermedad cura: dolor de cabeza
Nombre común de la planta: Ortiga
Familia: Urticaceae
Nombre científica: *Urena laevigata* (L.)
Gaudich. ex Wedd.

Parte de la planta utilizada: Las hojas

Medida de la parte de la planta utilizada:
1 hoja

Como se prepara el remedio: Se pone a calentar 1 hoja en el fuego y luego se pone en la cabeza.

Cantidad de veces a utilizar: Utilizar hasta que se quite el dolor.

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K'oj'a'anil tzak: chiibal pool
U k'aaba u xiw: Laal

Baax ku meyaj ti le tzakankil xiwo: u leec
Bukaaj ku meyaj ti le tzakanakil xiwo: 1 u leec

Bix u nak'anta le tzaco: Ka k'intik thee k'ak'oo le ku tzokle ka tzik ta tan jool.

Jay ten ku meyaj ti: Ka tzik hasta u le k'en luk'uk tech le k'inan pool.
Enfermedad cura: dolor de cabeza
Nombre común de la planta: Petzkinil
Familia: Agavaceae
Nombre científica: Manfreda petzkinil R. Orellana, L. Hern., & G. Carnevali

Parte de la planta utilizada: Las hojas

Medida de la parte de la planta utilizada:
1.-2.) 1-4 hojas

Cómo se prepara el remedio:
1.) Se muele o se machaca 4 hojas hasta que quede como pomada. Luego se pone en la cabeza.
2.) Deshebras 1 hoja o lo deshilas con aguja o con un cuchillo. Luego se pone en la cabeza y se amarra con una tela para que no se caiga la hoja.

Cantidad de veces a utilizar: Usarle hasta que deje de doler.

K’oja’nil tzak: chiibal pool
U k’aaba u xiw: Petzkinil

Baax ku meyaj ti le tzakankil xivo: u lee

Bukaaj ku meyaj ti le tzakankil xivo:
1.-2.) 1-4 u lee

Bix u mak’antaal le tzacoo:
1.) Ka uch’ik wa ka puch’ik p’is u p’atal bey pomada. Le ku tzokle ka tzik ta pool.
2.) Ka tziktkik yetel un p’el cuchillo wa yetel un p’el p’utz. Le ku tzokle ka tzik ta pool, ka k’axik yetel un p’el xet’ nok’ u tial mu lubul u lee.

Jay ten ku meyaj ti: Ku meyaj tech hasta le ken xuuluk u k’inaan a pool.
Enfermedad cura: dolor del estómago
Nombre común de la planta: Apazote
Familia: Chenopodiaceae
Nombre científica: Chenopodium ambrosioides L.

Parte de la planta utilizada:
1.-2.) las hojas o 3.) la raíz

Medida de la planta utilizada:
1.) 13 hojas, 2.) 5 o 6 hojas, o 3.) 5 cm. de la raíz

Cómo se prepara el remedio:
1.) Se lavan muy bien las hojas y se deslizan en la mitad de un pote con agua. Después lo euelas y luego lo tomas.
2.) Se sancuchan las hojas en medio litro de agua y luego se toma tibieco.
3.) Se sancocha la raíz en medio litro de agua y se deja hervir. Se suspende y cuando este frío se toma.

Cantidad de veces a utilizar: Si es para niño se toma poquito a poco en lugar de agua. Si es para adultos pueden tomarlo en lugar de agua.

Recomendación: No va a tomar otro medicamento que contenga químicos.

K’oja’anil tzak: k’inan nak’
U k’aaba u xiw: Apazote

Baax ku meyaj ti le tzakanik xiwo:
1.-2.) u leel wa 5.) u motz.

Bukaaj ku meyaj ti le tzakanik xiwo:
1.) 13 u leel, 2.) 5-6 u leel, wa 3.) 5cm u motz

Bix u nak’anuul le tzacon:
1.) Ka p’oik malob u leel le ku tzokle ka puk’ik ichil tanchumuk pote jaa. Yan a maytik le ku tzokle ka wuk’ik.
2.) Ka chakik ichil tanchumuk litro jaa le ku tzokle ka wuk’ik bey k’millo.

3.) Ka chakik ichil tanchumuk litro jaa yetel yan a p’atik lok. Le ku tzokle ka ch’uwik le ken sisakee ka wuk’ik.

Jay ten ku meyaj ti: Wa u tiaal mejen palaal ku yuuk’ul ju jun p’itil tu lugar jaa. Wa u tiaal uukchi maak ku yuuk’ul tu lugar jaa.

U nuuk: Maa tan a wuk’ mix un p’el tzak yan tioob químicos.

La hierba de Apazote
U xiw Apazote

Las hojas de Apazote
U leel Apazote
Enfermedad cura: dolor de oído  
Nombre común de la planta: Orégano de Castilla  
Familia: Lamiaceae  
Nombre científico: *Origanum vulgare* L.  

Parte de la planta utilizada: las hojas  

Medida de la parte de la planta utilizada: 1 hoja  

Como se prepara el remedio:  
1.) Se calienta la hoja por 20 a 30 segundos. Después se tapa el oído con la hoja caliente.  
2.) Se calienta la hoja. Luego se exprime 3 gotas del jugo de la hoja en el oído.  

Cantidad de veces a utilizar:  
1.) Se puede poner durante 2 o 3 días seguidos, en la noche antes de que se duerma.  
2.) Solo una vez pero si no se pasa el dolor se puede aplicar otra vez.  

K’oj’a’anil tzak: k’inan xikin  
U k’aaba u xiw: Orégano de Castilla  

Baax ku meyaj ti le tzakanik xiwo: u lee  

Bukaaj ku meyaj ti le tzakanik xiwo: 1 u lee  

Bix u mak’anta le tzaco:  
1.) Ka k’inik u lee tak 20 a 30 segundos. Le ku tzockle ka makik a xikin yetel u lee bey chocojiloo.  
2.) Ka k’inik u lee. Le ken tzooke ka yetzik u k’ab tak oxp el gotas ti a xikin.  

Jay ten ku meyaj ti:  
1.) Ju beytal u meyaj ti tech tak kápel wa oxp’el k’in, de ak’ab antes a wenel.  
2.) Chen un ten, wa mun man u kinan a xikin ju beytal u meyaj ti tech tokaaten.
Enfermedad cura: dolor de oído
Nombre común de la planta: Orégano País
Familia: Verbenaceae
Nombre científica: *Lippia graveolens* Kunth.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
1-2 hojas

Como se prepara el remedio:
1.) Antes de dormir se calientan 2 hojas, y cuando quede tibio se pone sobre el oído.
2.) Se calientan 2 hojas y luego exprime el jugo en un algodón. Después pones el algodón en tu oído.
3.) Se calienta una hoja y se exprime el jugo en el oído.

Cantidad de veces a utilizar: Usarle hasta 2 días seguidos.

K'ojam'al tzak: k'irán xíkin
U k'aaba u xiv: Oregano País

Baax ku meyaj ti le tzakanikli xivo: u lee

Bukaaj ku meyaj ti le tzakanikli xivo: 1-2 u lee.

Bix u makaalal le tzaco: 1.) Le ken nakaaj chital wenele ka k'intik u lee, le ken p'atak chen chan k'inal ka tzik ta xikín.
2.) Ka k'intik le ku tzókle ka yetzik u k'ab ti un p'el p'itz, le ku tzókle ka tzik ta xik'in.
3.) Ka chékik u motz wa u xot ichil un p'el litro jai. Ka tzik u lavados.

Jay tek ku meyaj ti: Ku meyaj tech mantatz kaap'el k'in.
Enfermedad cura: dolor de ojo
Nombre común de la planta: Albahaca
Familia: Lamiaceae
Nombre científica: Ocimum basilicum L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada: 4-8 hojas

Como se prepara el remedio:
1.) Se mezcla o se mastican las hojas en un litro de agua y se lavan los ojos con el remedio.
2.) Se mastican las hojas y se exprime el jugo dentro del ojo.

Cantidad de veces a utilizar:
Se utiliza a cada rato, durante 2 o 3 días.

K’oja’anít tzak: K’inan ich
U k’aaba u xiw: Albahaca

Baax ku meyaj ti le tzakankil xiwo: u lee
Bukaaj ku meyaj ti le tzakankil xiwo: 4-8 u lee

Bix u mak’anta le tzaco:
1.) Ka yaach’tik u lee iehil un p’el litro jaa,
le ku tzookle ka p’oik a wich yel,.
2.) Ka yaach’tik u lee le ku tzokle ka yetzik
u k’aab ta wich.

Jay ten ku meyaj ti: Yan a taik la lah hora,
iehil kaap’el wa oxp’el k’in.

Las hojas de Albahaca
U lee Albahaca

La hierba de Albahaca
U xiw Albahaca
**Enfermedad cura:** dolor de muela
**Nombre común de la planta:** Akitz
**Familia:** Apocynaceae
**Nombre científico:** Thevetia gaumeri Hemsley

**Parte de la planta utilizada:** la resina

**Medida de la parte de la planta utilizada:** Hasta 4 gotitas

**Cómo se prepara el remedio:**
1.) Se aplica la resina en la muela que duele.
2.) Se gotea la resina sobre el algodón hasta humedecerlo y luego se aplica sobre la muela que duele.

**Cantidad de veces a utilizar:** Como 2-3 veces al día o hasta que calma el dolor.

**K’oja’anil tzak:** k’iinan koj
**U k’aaba u xiw:** Akitz

**Baax ku meyaj ti le tzanknil xiw:** u yitz

**Bukaaj ku meyaj ti le tzanknil xiw:** tak 4 ch’aj

**Bix u mak’antaal le tzacoa:**
1.) Ka ch’ajik yool a le koj ku k’inan.
2.) Ka ch’ajik u yitz yool a n’el algodón, le ku tzole ka tzik yool koj ku k’inan.

**Jay ten ku meyaj ti:** Tak kaap’el wa oxt’en un n’el k’in hasta u man tech le k’inan koj.
Enfermedad cura: dolor de muela
Nombre común de la planta: Kardo Santo
Familia: Papaveraceae
Nombre científica: Argemone mexicana L.

Parte de la planta utilizada: la resina

Medida de la parte de la planta utilizada: las gotas que sean necesarias

Cómo se prepara el remedio:
1.) Se golea directamente sobre la muela que duele.
2.) Se golea sobre un algodón hasta humedecerlo, y después se aplica sobre la muela que duele.

Cantidad de veces a utilizar: Usarle 2 o 3 veces al día.

K’oja’anil tzak: k’inan koj
U k’aaba u xiw: Kardo Santo

Baaax ku meyaj ti le tzakankil xiwo: u yitz
Bukaaj ku meyaj ti le tzakankil xiwo: ka ch’ajik le bukaaj ku k’abetal tech

Bix u mak’anal le tzacoo:
1.) Ka ch’ajik yoolal la koj ku k’inan.
2.) Ka ch’ajik yoolal un p’el algodón, le ku tzokle ka tzik yoolal koj ku k’inan.

Jay ten ku meyaj ti: Ka tzik 2 wa 3 un p’el k’in.
Enfermedad cura: dolor de muela
Nombre común de la planta: Moraz
Familia: Moraceae
Nombre científico: *Machala tinctoria* (L.) D. Don & Steud.

Parte de la planta utilizada: la resina

Medida de la parte de la planta utilizada: las gotas que sean necesarias

Como se prepara el remedio:
1.) Se hunde el algodón con la resina y se pone en la muela que duele.
2.) Se gotea directamente sobre la muela que duele.

Cantidad de veces a utilizar:
Se puede utilizar hasta 3 veces al día pero se espera 2 horas entre cada aplicación.

K’oja’ atil tzak: k’inan koj
U k’aaba u xiv: Moraz

Baax ku meyaj ti le tzakankil xiwo: u yitz

Bukaaj ku meyaj ti le tzakankil xiwo: le bukaaj ku k’aabetal tech

Bix u mak’anta le tzaco:
1.) Ka ch’ilik le pitzoo yetel a yitz moraz le ku tzokle ka tzik ta koj ku k’inan.
2.) Ka ch’ilik yoolu koj ku k’inan.

Jay ten ku meyaj ti: Ku beytal u mejay tech 3 ti un p’el k’ín, yan a pa tik u man 2 horas ichil cada tzak.
**Enfermedad cura:** fogajes
**Nombre común de la planta:** Plátano (manzano o negro)
**Familia:** Musaceae
**Nombre científico:** Musa x paradisiaca L.

**Parte de la planta utilizada:** la resina

**Medida de la parte de la planta utilizada:**
1 gota para bebés y 9 gotas para adultos

**Cómo se prepara el remedio:**
Se gotea la resina en una cuchara con agua para bebés y 5 cucharas con agua para adultos. Después lo embucha y luego lo escupe.

**Cantidad de veces a utilizar:** Lo usa hasta que se euren los fogajes.

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**K’oja’anil tzak:** k’ak’
**U k’aab u xiw:** Ja’as (mazama o box)

**Baax ku meyaj ti le tzakankil xiwo:** u yitz

**Bukanaj ku meyaj ti le tzakankil xiwo:** 1 ch’aj u tiak mejen chambal wa u tiak rejoech mak 9 ch’aj

**Bix u mak’anta le tzuco:** Ka ch’ajik ichil un p’el chan loop jaa u tiak chambal tetel 5 loop jaa u tiak nukuch mak.

**Jay teu ku meyaj ti:** Ka tzik hasta u yutztal tech le k’ak’oo.
Enfermedad cura: fogajes
Nombre común de la planta: Pomoche'
Familia: Euphorbiaceae
Nombre científica: Jatropha gaumeri
Greenm.

Parte de la planta utilizada: la resina

Medida de la parte de la planta utilizada:
las gotas que sean necesarias

Como se prepara el remedio:
1.) Se gotea la resina sobre los fogajes y lo embucha.
2.) Se pone la resina en un vaso y luego se embucha.

Cantidad de veces a utilizar: Lo puede usar a cada rato hasta que se curen los fogajes.

K'oja'mil tzak: k'ak'
U k'aaba u xiw: Pomoche'

Baax ku meyaj ti le tzakanik xiw: u yitz
Bukaaj ku meyaj ti le tzakanik xiw: le bukaah ku k'abeltal tech

Bix u mak'anta le tzaco:
1.) Ka sh'ajik a yitz yool x'ak'oo le ku tzookle ka p'uukik.
2.) Ka izik u vitz ichil un p'el vaso le ku tzookle ka p'uukik.

Jay ten ku meyaj ti: Ku beytal a izik la lah horá p'is le ken utzak le k'ak'oo.
Enfermedad cura: fogajes
Nombre común de la planta: Siklite'
Familia: Euphorbiaceae
Nombre científica: Jatropha curcas L.

Parte de la planta utilizada: la resina

Medida de la parte de la planta utilizada: la resina de 3 hojas

Como se prepara el remedio: Se getea la resina sobre los fogajes. Luego lo embuchas y lo escupes.

Cantidad de veces a utilizar: Durante 3 días seguidos.

K'oj'anil tzak: k'ak'
U k'aaba u xiiv: Siklite'

Baax ku meyaj ti le tzakankil xiwo: u yitz
Bukaaj ku meyaj ti le tzakankil xiwo: u yitz 3 u leec
Bix u mak'antuul le tzaco: Ka ch'ajik yoolale k'ak'oo. Le ku tzókile ka p'uxik yetel ka tubik.
Jay ten ku meyaj ti: Mantatz 3 k'in.
Enfermedad cura: gastritis
Nombre común de la planta: Menta de Monte
Familia: Lamiaceae
Nombre científica: Ocimum compechianum Mill.

Parte de la planta utilizada: las hojas
Medida de la planta utilizada: 1 puño

Como se prepara el remedio: Se sancocchan las hojas en medio litro de agua y luego se toma.

Cantidad de veces a utilizar: a cada rato

K'oja'anil tzak: ele' ch'ik'
U k'aaba u xiw: Kakaltún

Baax ku meyaj ti le tzakankil xiwo: u lec
Bukaaj ku meyaj ti le tzakaakil xiwo: 1 wōol k'ab
Bix u mak'antaal le tzaco: Ka chakik ichit tanēhumuk litro jaa le ku tzokle ka wuk'iik.

Jay ten ku meyaj ti: la lah hora
Enfermedad cura: granos
Nombre común de la planta: Chiquita
Familia: Cucurbitaceae
Nombre científica: *Momordica charantia* L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
1-2 puños

Como se prepara el remedio: Se sancoschan las hojas en medio litro de agua, se deja hervir, y se suspende. Cuando este tibio se lava la parte afectada por los granos.

Cantidad de veces a utilizar: 2-4 veces al día, por 2 días seguidos.

K’oj’a’nil tzak: mejen chuchun
U k’aaba u xiw: Chiquita

Baax ku meyaj ti le tzakankil xiwo: u lee

Bukaaj ku meyaj ti le tzakankil xiwo: 1-2 wóol k’ab

Bix u mak’anta le tzaco: Ka chakik ichil tanchunuk litro jaa, ka chaai k u luk, le ku tzokle ka ch’yuik. Le ken p’atak chen chan k’ina ka p’oik le mejen chuchun yekel.

Jay ten ku meyaj ti: 2-4 u pakal k’ina, mantatz 2 k’in.
Enfermedad cura: granos
Nombre común de la planta: Chiquita, K’anan, Granada, y Guayaba
Familia: Cucurbitaceae, Rubiaceae, Punicaceae, y Myrtaceae
Nombre científica: Momordica charantia L., Homelia potens Jaceq., Punica granatum L., y Psidium guajava L.

Parte de la planta utilizada: varias hojas de cada planta

Medida de la planta utilizada: 2 puños de cada planta

Como se prepara el remedio: Se sancohan las hojas en 2 litros de agua y cuando queda amarillo se suspende. Cuando este tibecito se baña.

Cantidad de veces a utilizar: solo una vez

K’oja’unik tzak: mejen chuchun
U k’anab u xiv: Chiquita, K’anan, Granada, yetel Pichii

Baax ku meyaj ti le tzakanik xivo: u lee tii ju jun p’el

Bukaaj ku meyaj ti le tzakanik xivo: 2 woöl k’ab tii ju jun p’el

Bix u mak’antial le tzacoo: Ka chakik ichiil 2 litro jaa le ken p’atak k’ank’an ka ch’uyik. Le ken p’atak chen chun k’inal ka wiehinik.

Jay ten ku meyaj ti: chen un pak.

Las flores de K’anan
U lool K’anan

El arbusto de K’anan
U che’ ma’ tu jaan kiimil K’anan

El arbusto de Granada
U che’ ma’ tu jaan kiimil Granada

El arbol de Guayaba
U che’ Pichii
Enfermedad cura: infección de la vejiga
Nombre común de la planta: Nema`ax
Familia: Boraginaceae
Nombre científico: Heliotropium angiospernum Murray

Parte de la planta utilizada: las hojas o las raíces

Medida de la planta utilizada: 1 puño de hojas o 9 pedazos de raíces hasta 3 cm.

Como se prepara el remedio: Se sancocha las hojas o raíces en medio litro de agua y después lo toma o se da en lavados.

Cantidad de veces a utilizar: A cada hora hasta tomar todo el remedio.

K'oj'a'anil tzak: yaya wix
U k'aaba u xiv: Nema`ax

Baax ku meyaj ti le tzakankil xiwo: u lec wa u motz

Bukaaj ku meyaj ti le tzakankil xiwo: 1 wool k ab u lec wa 9 u xot'ol u motz de 3 cm.

Bix u mak'antaal le tzacoo: Ka chakik ichil tanchumuk litro jaa le ku tzokle ka wuk'ik wa ka tzik u lavados.

Jay ten ku meyaj ti: Ka wuk'ik la la hora hasta la xupik le tzakoo.
Enfermedad cura: infertilidad
Nombre común de la planta: Chalche'
Familia: Asteraceae
Nombre científica: Pluchea carolinensis (Jacq.) G. Don

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada: hasta 4 hojas

Como se prepara el remedio: Se sancochan las hojas en un litro de agua. Luego se le agrega hasta 3 o 4 cucharitas de miel. Después se deja hervir y luego se toma tibia con.

Cantidad de veces a utilizar: Se toma todo en un día (tomarlo durante tu menstruación).

K’oja’anil tzak: un tul kolel ma tu pajal u tzik pal
U k’aaba u xiw: Chalche'

Baax ku meyaj ti le tzakankil xivo: u leen
Bukaaj ku meyaj ti le tzakankil xivo: tak 4 u leen

Bix u mak’anial le tzaco: Ka chakik ichil un p’el litro jas. Le k’tzok leka t’zik oxp’el wa kamp’el mejen eucharah kab, ka p’atik lok, le k’en p’atik ehen k’inat ka wuk’ik.

Jay ten ku meyaj ti: Ka wuk’ik bul k’in (ka wuk’ik mantatz tan a wika mei).
**Enfermedad cura:** mal de ojo  
**Nombre común de la planta:** Chinchinpool ojo, Oxoxo, y Ruda  
**Familia:** Euphorbiaceae, Fabaceae, y Rutaceae  
**Nombre científica:** *Pïyllanthus fëras* Stendley, *Abrus precatorius* L., y *Ruta graveolens* L.  

**Parte de la planta utilizada:** varias hojas de cada planta  
**Medida de la planta utilizada:** 1 puñó de cada planta  
**Como se prepara el remedio:** Se sancochan las hojas en 2 litros de agua y luego se baña al niño con el remedio.  
**Cantidad de veces a utilizar:** solo una vez.

**K’oja’anil tzak:** k’ak’as ich  
**U k’aaba u xiw:** Chinchinpool Ojo, Oxoxo, yetel Ruda

**Baax ku meyaj ti le tzakanik xiwo:** u lee tii ju jun p’el.  
**Bukaaj ku meyaj ti le tzakanik xiwo:** 1 wööl k’ab tii ju jun p’el.  
**Bix u mak’anataal le tzacoo:** Ka chakik ichil 2 litro jna yetel le ku tzokle ka wichiniik le paal yeteloo.  
**Jay te’ ku meyaj ti:** chen un pak.
Enfermedad cura: mal de ojo
Nombre común de la planta: Ruda
Familia: Rutaceae
Nombre científico: Ruta graveolens L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
1 ramita

Cómo se prepara el remedio:
Se mastica las hojas y luego se escupe en la frente del niño 9 veces. Después se sopla su cara con la ruda 9 veces. Luego la persona mete su dedo (con olor a Ruda) en la boca del niño. Últimamente se hace una cruz en la frente y en su mano del niño.

K'ọja'anil tzak: k'ak'as ieh
U k'aaba u xiw: Ruda

Baax ku meyaj ti le tzakankil xiwo: u lee
Bukaaj ku meyaj ti le tzakankil xiwo: 1 xot' un chan k'ab

Bix u mak'antal le tzaco: Ka chachehk u lee, le ten tzooke ka tubik tu tanjooral let chan xiipal nueve u pakal. Le ku tzooke ka wustik u yich yatel le Ruda nueve u pakal. Le ku tzooke le max ustoo yan u jujku dedo bok ruda tu chi le paloo. Le ku tzooke ku mental u cruz tu tan jooral yatel tu tan u k'ab le paloo.

El arbusto de Ruda
U che' ma' tu jian kilnil Ruda

Las hojas de Ruda
U lee Ruda

Las flores y los frutos de Ruda
U lool yatel u yich Ruda
Enfermedad
Enfermedad cura: mal de ojo
Nombre común de las plantas: Ruda y Anís
Familia: Rutaceae y Convolvulaceae
Nombre científica: *Ruta graveolens* L. y *Turbinia corymbosa* (L.) Raf.

Parte de la planta utilizada: las hojas

Medida de la planta utilizada:
1.) se utiliza la ramita de hojas que se encuentra muy en la plantita de la mata
2.) 2 o 3 ramitas
3.) medio puño a un puño de hojas

Como se prepara el remedio:
1.) Se sacocharan las hojas de Ruda y un sobreclito de Anís en medio litro de agua. También se le agrega un poquito de sal. Cuando este frío se cuele en un pedazo de trapo. Después se tome.
2.) Se mastica el Anís y la Ruda juntos. Luego se escupe la mezcla en la cara del niño.
3.) Se mastrujan las hojas de Ruda en medio vaso de agua con Anís. Luego se lava la cara del niño con la mezcla.

Cantidad de veces a utilizar:
1.) por cuatrados a cada rato
2.) solo una vez
3.) 1-3 veces al día

K’oj’aníl tzak: k’ak’as ich
U k’aaba u xiw: Ruda yetel Xtabentun

Bax ku meyaj ti le tzakankil xiwó: u lec

Bukaj ku meyaj ti le tzakankil xiwó:
1.) ku meyaj tech un chan xa ay ka kastik jach txul u chei
2.) 2 wa 3 u mejen xa ay
3.) tanchumuk wa un p’el xwóol k’ab

Bix u mak’antaal le tzacoo:
1.) Ka chak’ik ichil tanchumuk litro jaa yetel yan a tik un p’el chan sobre anís yetel un p’it taab ichil. Le ken sisakee ka mayit il le ku tzokle ka wuk’ik.
2.) Ka chaachi tik le ruda yetel le anis. Le ku tzokle ka tubik tu yich le paloo.
3.) Ka yaach’ik ichil tanchumuk litro jaa yetel anis. Le ku tzokle ka p’iik u yich le paal yeteloo.

Jay ten ku meyaj ti:
1.) mejen loop lah hóra
2.) chen un pak
3.) 1-3 pak un p’el k’in

El bejuco de Anís
*U aak’ Xtabentun*

Las hojas y las flores de Anís
*U lee yetel u bol Xtabentun*
**Enfermedad cura:** mordedura de serpiente
**Nombre común de la planta:** Papaya del Monte
**Familia:** Caricaceae
**Nombre científico:** *Carica papaya* L.

Parte de la planta utilizada:
1.) la resina de un fruto chico
2.) la raíz

Medida de la parte de la planta utilizada:
1.) 4-5 gotas de la resina
2.) 5 cm. del raíz

Como se prepara el remedio:
1.) Se exprime la resina sobre la herida.
2.) Se machaca la raíz y se pone en la herida.

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**K'oj'anil tzak:** chibal kan
**U k'aab u xiv:** Ch'ich' Puut

**Baax ku meyaj ti le tzakankil xiwo:**
1.) u yitz um p'el yich chiehan
2.) u motz

**Bukaaj ku meyaj ti le tzakankil xiwo:**
1.) 4-5 u ch'ajal u yitz
2.) 5 cm. u motz

**Bix u mak'antal le tzaco:**
1.) Ka ch'ajik a yitz yoolale.
2.) Ka puch'ik u motz, le ku tzokle ka tzaik yoolale.
Enfermedad cura: mordedura de serpiente
Nombre común de la planta: Viperol
Familia: Malvaceae
Nombre científica: Abelmoschus moschatus Medik

Parte de la planta utilizada: las semillas

Medida de la parte de la planta utilizada:
1-2 tiras de semilla, 5 semillas, o un puño

Como se prepara el remedio: Se mastican las semillas y se tragan.

Cantidad de veces a utilizar: Las come hasta que se cure.

K’oja’anil tzak: chibal kan
U k’aaba u xiw: Viperol

Baax ku meyaj ti le tzakankil xiwo: u nek’

Bukaaj ku meyaj ti le tzakankil xiwo: 1-2 u nek’, 5 nek’, wa un chaeh

Bix u mak’anja le tzuco: Ka chaachk u vich yetel ka luk’ik.

Jay ten ku meyaj ti: Yan u xuulu umaoyaj ti teeh le ken utzakeeh.
Enfermedad cura: espasmo del estomago
Nombre común de la planta: Naranja Agria
Familia: Rutaceae
Nombre científica: Citrus aurantium L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada: 6-8 hojas

Como se prepara el remedio: Se sancochan las hojas en medio litro de agua y también se le agrega una bolita de ceniza que se encuentra en el fondo de la ceniza (ya esta formada en bolita) o un poco de bicarbonato. Se pone a hervir. Luego se suspende y se toma tibiecito.

Cantidad de veces a utilizar: Tomalo 2 veces al día. Lo puede tomar hasta 2 días seguidos.

Recomendaciones: No tomar agua hía, ni comer nada helado.

K’oja’anil tzak: tu’u kee
U k’aaba u xiw: Pak’al

Baax ku meyaj ti le tzakankik xiwo: u leee

Bukaaj ku meyaj ti le tzakankik xiwo: 6-8 u leee

Bix u nak’anta le tzaco: Ka chakik u leee ichil tuachumuk litro jaa yetel yan a tzik un p’el chan bolita tan ka kastik tu xul le taano yetel un p’it bicarbonato. Le ken lokezke ka ch’uik, le ken p’atat ci ten chan k’ina ka wuk ’ik.

Jay teu ku meyaj ti: Ka wilk’ik kaaten un p’el k’in mantatz kaap’el k’in.

U nuuk: Ma tana wuk’ sis jaa, yetel maa tana jant mixba sis.
Enfermedad cura: espasmo de la sangre
Nombre común de la planta: Naranja Agria
Familia: Rutaceae
Nombre científica: Citrus aurantium L.

Parte de la planta utilizada:
1.) el fruto o 2.-3.) las hojas

Medida de la planta utilizada:
1.) 1 fruto, 2.) 10 hojas, o 3.) 20 hojas o 2 puños

Cómo se prepara el remedio:
1.) Se entierra el fruto en la ceniza caliente y cuando esté cocido se saca. Se deja enfriar y cuando este listo se chupa.
2.) Se sancochan las hojas en medio litro de agua y luego se toma de una sola vez.
3.) Se sancochan las hojas en 2 litros de agua. Se deja enfriar y luego se baña.

Cantidad de veces a utilizar:
1.) 3 días seguidos
2.) a cada rato
3.) solo una vez al día

Recomendación: No se va a tomar agua fría.

K'oja'anit tzak: k'iich' espasmado
U k'aaba u xiv: Pak'al

Baax ku meyaj ti le tzakankil xivo:
1.) u yich wa 2.-3.) u leec

Bukaaj ku meyaj ti le tzakankil xivo:
1.) 1 u yich, 2.) 10 u leec, 3.) 20 u leec wa 2 xwóol k'ab

Bix u mak'antual le tzace:
1.) Ka mukik u yich ichil choko taan le ken tajkee ka joosit. Ka p'atik sistal le ken p'atak chen chan k'inal ka chuuchik u k'aah.
2.) Ka chakik u leec ichil tanchumuk litro jaa le ken p'atak chen chan k'inal ka wuk'ik.

3.) Ka chakik u leec ichil kaap el litro jaa. Ka p'atik sistal le ku tzokte ka wichintik.

Jay ten ku meyaj ti:
1.) mantatz 3 k'in
2.) la laa hora
3.) chen un pak un p'el k'in

U nuuk: Maa tan a wuk'sis jaa.

El árbol de Naranja Agria
U che' Pak'al

El fruto y las hojas de Naranja Agria
U yich yetel u leec Pak'al
Enfermedad cura: piedras en los riñones
Nombre común de la planta: Cabello de Elote, Chaya, y Elemuy
Familia: Poaceae, Euphorbiaceae, y Annonaceae
Nombre científica: Zea maya L.,
Cnidoscolus aconitifolius (Mill.) L.M.
Johnston, y Melmea depressa (Baill) R.E.
Fries
Parte de la planta utilizada: el cabello de Elote, la raíz de Elemuy, y las hojas o las raíces de Chaya
Medida de la parte de la planta utilizada: Un puño de cabello de Elote, 3-10 cm. de raíz de Elemuy, y 10 hojas o 7-10 cm. del raíz de Chaya
Como se prepara el remedio: Se sancochan las partes de las plantas en medio litro de agua y se deja hervir. Luego se suspende. Después se deja enfriar y se toma.
Cantidad de veces a utilizar: 3 veces al día, antes de cada comida, durante una semana
K'oj'an'il tzak: piedra
U k'anaa u xiw: Tzuk Nal, Chay, yetel Elemuy
Baax ku meyaj ti le tzakan'kil xiwo: u tzuk Nal, u motz Elemuy yetel u lee wa u motz Chay
Bukaaq ku meyaj ti le tzakan'kil xiwo: 1 wóol, k'ab u tzuk Nal, 3-10 cm. u motz Elemuy, yetel 10 cm. u lee wa 7-10 cm. u motz Chay
Bix u nak'antaal le tzaco: Ka chakik ichil taqumuk litro jau yetel ka p'aik lok. Le ku tzokle ka ch'uyik. Ka p'atik sistal. Le ku tzokle ka wuk'ik.

Jay ten ku meyaj ti: 3 un p'el k'in, le ken nakaaj janal, ti un p'el sema

El arbusto de Chaya
U che' ma' tu jian kimil Chay

El árbol de Elemuy
U che' Elemuy

La flor y las hojas de Elemuy
U lool yetel u lee Elemuy
**Enfermedad cura:** quemadas

**Nombre común de la planta:** Tomate

**Familia:** Solanaceae

**Nombre científico:** *Solanum lycopersicum* L.

**Parte de la planta utilizada:** el fruto tierno (verde) o las hojas

**Medida de la parte de la planta utilizada:**
1 tomate o 1-2 hojas

**Cómo se prepara el remedio:** Se exprime el jugo del tomate o de las hojas sobre la quemada.

**Cantidad de veces a utilizar:** Utilizarlo hasta 3 veces al día.

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**K'oja'anil tzak:** chuju
U k'aaba u xiw: P'ak

**Baaax ku meyaj ti le tzakankil xiwo:** u yich yaux wa mae u lee

**Bukaaj ku meyaj ti le tzakankil xiwo:** 1 p'ak wa 1-2 u lee

**Bix u mak'anita le tzaco:** K'a yetzik u k'ab le p'ak wa u lee yoole chujuuoo.

**Jay ten ku meyaj ti:** Ku betyal a tzik 3 un p'el k'in.
**Enfermedad cura:** saes una esquina
**Nombre común de la planta:** Utsukpek'
**Familia:** Apocynaceae
**Nombre científico:** Tabernaemontana amygdalefolia Jacq.

**Parte de la planta utilizada:** la resina

**Medida de la parte de la planta utilizada:**
1-3 gotas

**Como se prepara el remedio:** Lo gotean sobre la parte donde se encuentra el espinó.

**Cantidad de veces a utilizar:** Lo usa hasta que salga el espinó.

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**K'oja’anil tzak:** ku jeosik un p’el k’ix
**U k’aaba u xiw:** Utsukpek’

**Baax ku meyaj ti le tzaakanil xiwo:** u yitz

**Bukaaj ku meyaj ti le tzaakanil xiwo:** 1-3 ch’aj

**Bix u mak’anta le tzuco:** Ka ch’a jik yoolale k’iixoo.

**Jay ten ku meyaj ti:** Ku tzik hasta le ken jooke k’iixoo.
Enfermedad cura: tos
Nombre común de las plantas: Aguacate
Familia: Lauraceae
Nombre científica: 

Parte de la planta utilizada: las hojas

Medida de la planta utilizada: 4-9 hojas o 1 puño

Como se prepara el remedio: Se sansecochan las hojas en medio litro de agua y se dejan hervir. Se suspende y se le agrega 3 cucharitas de riel. Cuando este tibieto se toma.

Cantidad de veces a utilizar: a cada rato

K'oj'anil tzak: sasak’ kal
U k’aaba u xiw: Oon

Baax ku meyaj ti le tzakankil xiwo: u leec
Bukanj ku meyaj ti le tzakaankil xiwo: 4-9
u leec va 1 wœel k’ab

Bix u mak’anbal le tzacoo: Ka chakik
ichil tanchumuk litro jaa yetel yan a p’atik
lok. Le ku tzokle ka ch’uyik yetel ka t’o’ojik 3
mejen loop kab tehul. Le kon p’atik ehel
chan k’inal ka wuk’ik.

Jay ten ku meyaj ti: la lah hora
Enfermedad cura: tos  
Nombre común de la planta: Limón Pais  
Familia: Rutaceae  
Nombre científica: Citrus limonía Osbeck  
Parte de la planta utilizada: el jugo del fruto  
Medida de la parte de la planta utilizada:  
1.-2.) 1 limón  
3.) 4 limones  
Como se prepara el remedio:  
1.) Se exprime el jugo de 1 limón en medio vaso de agua caliente y luego le agregas miel al gusto. Después lo tomas tibieciio.  
2.) Entierras 1 limón en la ceniza de 20 a 30 minutos y después lo sacas. Cuando este tibio lo chupas.  
3.) Se mezcla el jugo de 4 limones con miel al gusto. Luego el jugo se hierve y después se toma tibieciio.  
Cantidad de veces a utilizar: Se toma a cada rato durante 2 días seguidos. También se puede tomar antes de dormir.  
K’oj’a’anil tzak: sasak’ kal  
U k’aaba u xiv: Limón Pais  
Baux ku meyaj ti le tzakankil xivo: u k’aab u yich  
Bukaaj ku meyaj ti le tzakaakil xivo:  
1.-2.) 1 limón  
3.) 4 limón  
Bix u mak’antaal le traco:  
1.) Ku yeeetz e k’aab le limón ichil tanchumuk vaso choko jaa, le ku tzokle ka tzik un p’it kah schil. Le ken p’atak chen luumuk’ ka wuk’ik.  
2.) Ka mukik 1 limón ichil taan tak 20 wa 30 minutos le ku tzokle ka joosik. Le ken p’atak chen k’ina ka chuuchik u k’aab.  
3.) Ka xaak’ tik u k’ab-4 limón yetel un p’it kab. Le ku tzokle ka lokansik. Le ken p’atak chen k’ina ka wuk’ik.  
Jay ten ku meyaj ti: Ka wuk’ik la tah hora mantatz 2 k’in. Ku bettal a wuk’ik le ken xiukeeh wenel.
Enfermedad cura: tos
Nombre común de la planta: Sak Beek
Familia: Oláceae
Nombre científica: *Schoepfia schreberi* J.F. Gmelin

Parte de la planta utilizada: la corteza o las hojas

Medida de la parte de la planta utilizada: 5-10 cm. o 9 hojas

Como se prepara el remedio: Se sancocha la corteza o las hojas en medio litro de agua. Se deja hervir y luego se suspende. Después se toma librecito. Se puede agregar 2 cacharitas de miel antes de que se tome.

Cantidad de veces a utilizar: 3 veces al día hasta que se cure.

K'oja’anil tzak: sasak’ kal
U k’aaba u xiv: Sak Beek

Baax ku meyaj ti le tzakanik xiwo: u xot wa u lee

Bukaaj ku meyaj ti le tzakanik xiwo: 5-10 cm. wa 9 u lee

Bix u mak’an a le tzaco: Ka chakik ichil tanchumuk litro jaa, ka p’atik lok le ku tzokle ka ch’uvik. Le ken p’atak chen chan k’inat la wuk’ik. Ju beytal a t’ojik 2 mejen loop kab ichil antes a wuk’ik.

Jay tey ku meyaj ti: 3 un p’del k’in
Enfermedad cura: tos
Nombre común de la planta: Zacate de Limón
Familia: Poaceae
Nombre científica: Cymbopogon citratus (DC. ex Nees) Stapf.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
2-3 hojas

Como se prepara el remedio: Se sancchan las hojas en medio litro de agua y se le agrega miel o azúcar al gusto. Se toma tibia.

Cantidad de veces a utilizar: Tómalo a cada rato por 2 días seguidos.

Recomendación: No se debe de tomar agua fría ni helado.

K'oja'anil tzak: sasak' kal
U k'aaba u xiw: Zacate de Limón

Baax ku meyaj ti le tzakankil xiwó: u leec

Bukaaj ku meyaj ti le tzakaankil xiwó: 2-3 u leec

Bix u nak'anta le tzaco: Ka chakik ichil tanchumuk litro jaa, yetel ka t'oijk u' p'it kab wa az' ucar ichil. Le ku izolde ka wuk'ik bey k'mihóo.

Jay teu ku meyaj ti: Ka wuk'ik la lah hora hasta ken u xupe. Ka wuk'ik mantatz 2 k'ín.

U nuuk: Maa tan a wak'ik jaa sis.
Enfermedad cura: verrugas
Nombre común de la planta: Ik’aban
Familia: Euphorbiaceae
Nombre científico: Croton humilis L.

Parte de la planta utilizada:
1.) la resina o 2.) la raíz

Medida de la parte de la planta utilizada:
1.) 1-2 gotas de resina o 2.) 5cm. de raíz

Cómo se prepara el remedio:
1.) Se aplica 1-2 gotas de la resina sobre cada verruga.
2.) Se sancocha la raíz en medio pote con agua, y luego se aplica sobre las verrugas.

Cantidad de veces a utilizar:
1.) Solo una vez al día, mientras tenga la verruga lo puede utilizar.
2.) solo una vez.

Recomendación: No se usa para muchas verrugas a la misma vez.

K’oja’unil tzak: ax
U k’aaba u xiv: Ik’aban

Baux ku meyaj ti le tzakankil xivo:
1.) u yitz wa 2.) u motz

Bukaaj ku meyaj ti le tzakaankil xivo:
1.) 1-2 ch’aj wa 2.) 5 cm. u motz

Bix u mak’antaal le tzacoo:
1.) Ka izik yoolale axoo.
2.) Ka ehakik ichil tanehumuk pote jaa le ku tzokle ka izik yoolale axoo.

Jay teu ku meyaj ti:
1.) Chen un pak ti un p’el k’in. Ju beytal u meyaj tech wa xulu yan tech le axoo.
2.) chen un pak.

U Nuuk: Maa tan a tza toola yaah ax ti un pak.
Enfermedad cura: vomito  
**Nombre común de la planta:** Apazote  
**Familia:** Chenopodiaceae  
**Nombre científico:** Chenopodium ambrosioides L.

**Parte de la planta utilizada:**  
1.) las hojas o 2.) la raíz 

**Medida de la parte de la planta utilizada:**  
1.) 4-8 hojas o 2.) 5 cm. raíz 

**Como se prepara el remedio:**  
1.) Se sancochan las hojas en un vaso con agua, y se toma tibiecto.  
2.) Se sancocha la raíz en medio litro de agua, se deja hervir, y se toma tibiecto. 

**Cantidad de veces a utilizar:**  
1.) Lo tomas poco a poco durante el día hasta que lo gastes.  
2.) Lo tomas hasta 2 veces al día. Si no se le pasa, puedes tomar otro al día siguiente. 

**K’oja’anil tzak:** xej  
U k’aaba u xiw: Apazote 

**Baax ku meyaj ti le tzakankil xiwo:**  
1.) u leex wa 2.) u motz 

**Bukaaj ku meyaj ti le tzakankil xiwo:**  
1.) 4-8 u leex wa 2.) 5 cm u motz 

**Bix u mak’anta le tzac:**  
1.) Ka chakik u leex ileel un p’el vaso jaa, yetel ka wuk’ik k’iná.  
2.) Ka chakik u motz ichil tanchumuk litro jaa, ka chaakik u lok, le ken p’atak chen chau k’inal ka wuk’ik. 

**Jay ten ku meyaj ti:**  
1.) Ka wuk’ik ju jun p’itil ti un p’el k’in hasta ken a xupe.  
2.) Ka wuk’ik 2 un p’el k’in. Wa uma man teex ju beytal a wuk’ik u laa ta laa k’in.
Enfermedad cura: vómito
Nombre común de la planta: Sisin
Familia: Asteraceae
Nombre científica: Artemisia vulgaris L.

Parte de la planta utilizada: las hojas

Medida de la parte de la planta utilizada:
5-7 hojas

Como se prepara el remedio:
1.) Se tuesta en el comal. Se frotan las hojas entre las manos y se exprime en la mitad de un vaso con agua tibia. Después se toma.
2.) Se sancocha en medio litro de agua, lo cuele, y se toma tibiecéto.

Cantidad de veces a utilizar:
1.) solo una vez
2.) a cada rato

K'oj'a'nil tzak: xej
U k'aaba u xiw: Sisin

Baax ku meyaj ti le tzakankil xiwo: u lee

Bukaaj ku meyaj ti le tzakaankil xiwo: 5-7
u lee

Bix u mak'antaal le tzacooy:
1.) Ka pokik ti xamach. Ka jsxlk yetel ka yetzik ichil tanchumuk vaso k'ina jaa. Le ku tzokle ka wuk'ik.
2.) Ka chakik ichil tanchumuk litro jaa, ka maytik. Le ku tzokle ka wuk'ik bey k'iniloo.

Jay teu ku meyaj ti:
1.) chen un pak
2.) la lah hora
Índice de Nombres Comunes
Tzolaantakoob tii u K’abaa Índice

Aguacate, 70
Akitz, 49
Albahaca, 48
Anís, 62
Apazote 13, 14, 45, 75
Cabello de Elote, 67
Café, 17
Cebollina, 10
Chalche’, 59
Chay, 23, 67
Chaya, 23, 67
Ch’iich’ Puut, 63
Chinchinpool Ojo, 60
Chiquita, 54, 57
Ciruela, 28
Clavudosa, 27
Elemuy, 67
Flor de Santiago, 29
Granada, 57
Guayaba, 57
Hierbabuena, 14, 15
Ik’aban, 74
Ja’as, 33, 52
Jicara, 42
Kabalpixoy, 27
Kakaltun, 32, 39, 55
Kardo Santo, 50
K’an, 57
K’an Lool, 25
K’ulinsiis, 22
Laal, 21, 43
Le Abloo, 28
Le waa e la’anoo, 31
Limón País, 38, 71
Llantén, 18, 30
Luch, 42
Maiz, 31, 67
Menta de Monte, 32, 39, 55
Moraz, 51
Naranja agría, 11, 20, 24, 26, 65, 66
Nema’ax, 27, 58
Oon, 70
Oregano de Castilla, 46
Orégano País, 47
Ortiga, 21, 43
Oxxo, 60
P’ak, 68
Pak’al, 11, 20, 24, 26, 65, 66
Papaya del Monte, 63
Petzkinil, 44
Pichii, 57
Pitajaya, 40
Plátano, 33, 52
Pomolche’, 53
Puk’in, 34
Ruda, 62-62
Sábila, 16, 19
Sak Beek, 72
Siklité’, 54
Sisin, 76
Tomate, 68
Tortillas quemadas, 31
Tz’intaman, 12
Tzuk nal, 31, 67
Utzupek’, 69
Viperol, 64
Weech xiw, 35
X-K’o’ och, 17
X-Napche’, 36
X-Pepeltun, 41
Xtabentun, 62
Ya’a, 37
Zacate de Limón, 73
Zapote, 37
Índice de Nombres Científicos
U K'abaa Científico Índice

Abelmoschus moschatus Medik., 64
Abrus precatorius L., 60
Allium schoenoprasum L., 10
Aloe vera (L.) Burm. f., 16, 19
Antigonon leptopus Hook. & Arn., 29
Argemone mexicana L., 50
Artemisia vulgaris L., 76
Callicarpa acuminate Kunth., 34
Capsicua hislopa L., 27
Carica papaya L., 63
Chenopodium ambrosoides L., 13, 14, 45, 75
Cissampelos pareira L., 41
Citrus aurantium L., 11, 20, 24, 26, 65, 66
Citrus limonia Osbeck, 38, 71
Cnidocactus acentifolius (Mill.) L.M. Johnston, 23, 67
Coffea arabica L., 17
Crescentia cujete L., 42
Croton humilis L., 74
Cymbopogon citratus (DC. ex Nees) Stapf., 73
Euphorbia gaumeri Millsp., 35
Gossypium hirsutum L., 12
Handelma piatia Jacq., 57
Heliotropium angiospermum Murray, 27, 58
Hylocereus undatus (Haw.) Britton & Rose, 40
Jatropha curcas L., 54
Jatropha gauerni Greenm., 53
Lippia graveolens Kutch., 47
Mochura tinctoria (L.) D. Don & Steud., 51
Malpea depressa (Baill) R.E. Fries, 67
Malvastrum coronandianum (L.) Garcke, 27
Manfreda patkini R. Orellana, L. Isr., & G. Carnevali, 44
Manilkara sapota (L.) P. Royen, 37
Mantho x piperita L., 14, 15
Monamorina hortantia L., 56, 57
Musa x paradisiaca L., 33, 52
Ocimum basilicum L., 48
Ocimum campechianum Mill., 32, 39, 55
Origanum vulgare L., 46
Persea americana Mill., 70
Phyllanthus forsy Standley, 60
Plantago major L., 18, 30
Pluchea carolinensis (Jacq.) G. Don, 59
Psidium guayava L., 57
Punica granatum L., 57
Ricinus communis L., 17
Ruta graveolens L., 60-62
Salamm yepersicum L., 68
Scheptra schreberi J.F. Gmelin, 72
Spondias purpurea L., 28
Tabernamontana amygdaliformis Jacq., 69
Tecoma stans (L.) Juss. ex Kunth, 25
Thevetia gauerni Hemsley, 49
Trichilia hirta L., 22
Turbina corymbosa (L.) Raf., 62
Ureca baccifera (L.) Gaudich. ex Wedd., 21, 43
Ximenia americana L., 36
Zea mays L., 31, 67
Índice de Enfermedades
K’ojaaniloob Índice

Aire en el estómago, 10-11
Asma, 12
Ax, 74
Bichos, 13-15
Caida del cabello, 16
Calentura, 17
Calentura en el estómago, 18
Casp, 19
Casp en el cabello, 19
Chi’ibal kaan, 63-64
Chi’ibal nak’, 45
Chibal pool, 42-44
Chokuil, 17
Chokuil nak’, 18
Ch’ot nak’, 20-21
Ch’ujuk wix, 25-26
Chuju, 68
Cólico, 20-21
Comezón, 22
Cuando se seca la leche de una mamá, 23-24
Diabetes, 25-26
Diarrea, 27-37
Disentería, 38-41
Dolor de cabeza, 42-44
Dolor del estómago, 45
Dolor de oído, 46-47
Dolor de ojo, 48
Dolor de muela, 49-51
Ele’ naak’, 55
Espasmo del estómago, 65
Espasmo de la sangre, 66
Fogajes, 52-54
Gastritis, 55
Granos, 56-57
Infección de la vejiga, 58

Infertilidad, 59
K’aak’, 52-54
K’ak’as ich, 60-62
K’aak’as se’en, 12
K’i’ik’ nak’, 38-41
K’i’ik’ pasmado, 66
K’i’inan ich, 48
K’i’inan koj, 49-51
K’i’inan xikin, 46-47
K’i’ix, 69
Luubul too’otsel pool, 16
Mal de ojo, 60-62
Mefen chuchun, 56-57
Mina’an u k’ab yiim un tul koolel yamu chambal, 23-24
Mordedura de serpiente, 63-64
Piedra, 67
Piedras en los riñones, 67
Quemadas, 68
Sa’asak’ wiinkila, 22
Saca una espinha, 69
Sasaa kal, 70-73
Tos, 70-73
Tu’u kee, 65
Utuul ko’ole maa tu paa tu ts’iik paal, 59
U’ yok’al nak’, 10-11
U yok’el u nak’ mak, 13-15
Verrugas, 74
Vómito, 75-76
Waach’ k’aja, 27-37
Xej, 75-76
Yaya’ wix, 58
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318


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Allison Hopkins was born in Lansing, Michigan. She grew up in Williamston, Michigan, and in 1997 she graduated in the top 10 from Williamston High School. She earned her bachelor of science degree in botany and plant pathology with highest honors and a specialization in Latin American and Caribbean studies from Michigan State University. During her third year at Michigan State University, Allison spent a semester studying abroad at Escuela de Agricultura de la Region Tropical Humeda in Costa Rica. She did her senior research project in Costa Rica on medicinal plants. Allison graduated from Iowa State University in 2003 with a master’s degree in anthropology. During her master’s program, she carried out research in Panama on women’s use of medicinal plants for their reproductive health. Allison taught in the biology department at Drake University for one year after she graduated. In 2004, she enrolled in the PhD program in anthropology with a concentration in tropical conservation and development at the University of Florida. She pursued research on variation in medicinal plant remedy knowledge in Mexico.