



DAWEANEGÜWA ÜÜ

**Management of
vector-borne diseases in the
Department of Amazonas**

MANAGEMENT OF VECTOR-BORNE DISEASES IN THE DEPARTMENT OF AMAZONAS

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- Θ E.S.E Hospital San Rafael de Leticia (San Rafael Hospital of Leticia)
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PRESENTATION

Vector-borne diseases - VBDs - (daweanegüwa üü in the Tikuna language), are a significant public health problem in the Department of Amazonas due to the high prevalence of insect vectors and difficulties with medical access, especially for isolated indigenous communities. To reduce the incidence of VBDs, public health policies are needed that incorporate knowledge from Western medicine (biomedicine) and traditional medicine, with a view to achieving a more integral form of care that is adapted to the sociocultural conditions of the region.

The project “Care and Treatment Practices for the Management of Vector-Borne Diseases (VBDs) in the Department of Amazonas” is the result of the alliance between the indigenous community of Puerto Esperanza, the Colombia-Wisconsin One Health Consortium and the Universidad Nacional de Colombia. This is a joint effort to develop intercultural strategies focused on the management of VBDs, based on recognizing the needs and specific contexts of the Amazon communities, and on promoting the autonomy of the local population in decision-making related to their health.

The population of Puerto Esperanza mainly identifies as part of the Tikuna (Magüta) people. Therefore, we have prioritized the inclusion of the Tikuna language in the activities we have carried out together with the community. This has been fundamental both to strengthening knowledge acquisition and to complementing promotion and prevention processes of vector-borne diseases.

This information book compiles the experience and knowledge gained through the different activities carried out together with the community of Puerto Esperanza and with the various health institutions in the Department of Amazonas. We hope that this work, along with the other educational materials produced as part of this project, will help consolidate intercultural health education strategies for the improvement of the quality of life and well-being of the indigenous population of the Amazon region.

INTRODUCTION

RESEARCH PROBLEM

Infectious diseases are one of the most important public health issues, especially in tropical and subtropical areas. Vector-borne diseases account for 17% of infectious diseases, and are caused by a variety of parasites, bacteria, and viruses (WHO, 2020). Notable examples of VBDs transmitted to humans by hematophagous insects are malaria, dengue, Zika, yellow fever, chikungunya, Chagas disease, and leishmaniasis, which together cause more than one million deaths annually worldwide (WHO, 2020, Rajput et al., 2023).

The abundance and geographic/spatial distribution of vectors can be increased by economic, sociocultural and climatic factors, poor healthcare access, and limited effectiveness of control campaigns, in turn heightening the risk of VBD transmission (Gluber, 1998). In Colombia, approximately 12 million people live in endemic areas and are at risk of contracting infectious diseases such as malaria (Carvajal et al., 2013). Similarly, around 25 million are at risk of contracting dengue (World Mosquito Program, 2022). Given this situation, and their persistent, endemic-epidemic, emerging and re-emerging nature, VBDs are a public health concern in Colombia (Castañeda-Porras & Zuleta-Dueñas, 2018).

The Department of Amazonas is considered an endemic region for VBDs, and has seen an increase in malaria and leishmaniasis cases in recent years, while there is an underdiagnosis or lack of accurate prevalence data for dengue and Chagas disease (Padilla et al., 2017). These diseases mainly affect indigenous communities who live far from urban centers and face high costs for patient transport and accommodation, as well as being affected by the lack of healthcare equipment in indigenous reserves and the absence of secondary and tertiary hospitals in the department (Martínez et al., 2019).

The incidence of these diseases continues to rise in the region despite the implementation by the Departmental Health Secretariat of the Programs for the Promotion, Prevention, Control, and Elimination of VBDs, which aim to alleviate the economic and social problems associated with VBDs and to reduce the morbidity, disability, complications and mortality caused by these diseases (Minsalud, 2022).

The problem outlined above demonstrates the need to carry out research that promotes knowledge exchange and the appreciation of traditional practices related to the identification, management and treatment of infectious diseases and their vectors. This knowledge is essential in order to put in place strategies with an intercultural approach that ensure that the guidelines set in place by government programs are coordinated with local medical practices.

As Garzón (2022) notes, it is crucial that decisions regarding intercultural healthcare in the Department of Amazonas are based on key principles such as autonomy, active participation, and the direct involvement of traditional medicine practitioners. To achieve this, healthcare

models must be sensitive and respectful of the sociocultural dynamics particular to Amazonian communities, understanding that their knowledge and practices are not merely complementary but fundamental to building a more inclusive and effective healthcare system.

This study aims to provide information to support the development of intercultural care pathways for vector-borne diseases in the Department of Amazonas. In the future, this may help establish the roles and responsibilities of the different actors involved in planning, executing, and monitoring healthcare programs, as well as defining the intervention processes carried out by traditional and Western (biomedical) health practitioners during patient care.

OBJECTIVES

- **General Objective:**

To examine the current state of vector-borne disease management in the southern Department of Amazonas with a view to developing an intercultural promotion and prevention strategy that integrates knowledge systems and values traditional practices related to the care of these diseases.

- **Specific Objectives:**

- To characterize the use of medicinal plants, practices, care guidelines, procedures, and traditional medicine agents used in the management of vector-borne diseases.
- To assess the progress and limitations in the implementation of vector control promotion and prevention campaigns in indigenous communities in the southern Department of Amazonas.
- To identify plant species used to treat vector-borne diseases and phytochemical compounds with pharmacological potential.
- To create educational content on VBDs to complement promotion and prevention campaigns in collaboration with adults and children.

CONTEXTUAL CONCEPT

This text addresses five basic concepts, seeking to elucidate how an intercultural approach can be built and how traditional and biomedical knowledge can be integrated at different healthcare service levels. These concepts are briefly described as follows: 1) Vector-borne diseases (VBDs); 2) Programs for the promotion, prevention, control, and elimination of VBDs

and zoonoses; 3) Traditional indigenous medicine; 4) Biomedical system; 5) Intercultural health

- **Vector-borne diseases**

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Vector-borne diseases occur when the etiological agent that causes them (viruses, parasites, or bacteria) is transmitted through insect bites or contact with vector fecal material, with the most common organisms involved being mosquitoes, sandflies, triatomines, ticks, and fleas (Padilla et al., 2017). Common VBDs such as dengue, malaria, yellow fever, leishmaniasis, and Japanese encephalitis pose a high morbidity and mortality burden and a significant cost to healthcare systems (Cabrera et al., 2021).

In Colombia, 26 million people are at risk of contracting dengue, chikungunya, and Zika, while 12 million are at risk of malaria, Chagas disease, and leishmaniasis. This results from the fact that 85% of the population lives at altitudes below 1,600 meters above sea level. Moreover, these diseases occur in both urban and rural areas, leading to persistent endemic-epidemic conditions (MinSalud, 2022).

- **Programs for the promotion, prevention, control, and elimination of VBDs and zoonoses**

In Colombia, progress has been made with the Programs for the Promotion, Prevention and Control of VBDs led by health authorities at the national (Ministry of Health and Social Protection) or local (departmental or municipal health departments) level. These programs are based on cross-sector collaboration with public and private actors for the implementation of subprograms and projects targeted at social determinants of health, knowledge management, epidemiological intelligence, health promotion, and primary prevention of vector-borne diseases.

Currently, subprograms exist for the promotion, prevention, and control of malaria, dengue, Chagas disease, and leishmaniasis (MinSalud, 2022). As this study focuses on these diseases, they are briefly described below:

- Malaria: An infectious disease transmitted by the bite of *Anopheles* mosquitoes that are carriers of *Plasmodium* parasites. Symptoms include high fever, chills, excessive sweating, headache, and fatigue. It primarily affects tropical and subtropical regions, especially in Africa, Asia, and Latin America.
- Dengue: A viral infection transmitted by mosquitoes of the *Aedes* genus, particularly *Aedes aegypti*. It is characterized by symptoms including high fever, muscle and joint pain, severe headache, skin rashes, and, in some cases, bleeding. The virus has four different serotypes, so reinfection is possible. Severe cases can progress to hemorrhagic fever or shock, which can be fatal. Endemic regions include Southeast Asia, Latin America, and the Caribbean.

- Leishmaniasis: A parasitic disease transmitted by the bite of infected *Phlebotomus* or *Lutzomyia* mosquitoes. The disease has several clinical forms, the most common being cutaneous and visceral. Cutaneous leishmaniasis causes skin ulcers, while visceral leishmaniasis affects internal organs like the spleen, liver, and bone marrow and can be fatal if not treated. Leishmaniasis is endemic in tropical and subtropical regions such as the Middle East, Africa, Asia, and Latin America.
- Chagas Disease: This is caused by the parasite *Trypanosoma cruzi*, which is transmitted mainly by triatomine insects (also known as kissing bugs). The disease has two phases: acute and chronic. In the acute phase symptoms may be mild or non-existent, but the chronic phase can affect the heart and digestive system, which can in turn lead to severe complications such as heart failure. It is most common in rural areas of Latin America, although migration has caused it to spread to other parts of the world.

• Traditional Indigenous Medicine

Traditional medicine plays a crucial role in indigenous healthcare. This led to its recognition, in 1978, by the World Health Organization (WHO) as a robust combination of active medical practice and ancestral knowledge. It is a complex system that consists of knowledge, traditions, and practices administered by specialists such as healers, midwives, health promoters, massage practitioners and others.

These practitioners have unique diagnostic and treatment methods, as well as their own therapeutic resources, notably medicinal plants (PAHO, 2006). In recognition of the value of traditional medicine, the Pan American Health Organization (PAHO) launched the “Health of Indigenous Peoples of the Americas Initiative” in 1997, aiming to work with governments to improve the health of indigenous communities while promoting the preservation and valuing of their ancestral knowledge.

• Biomedical System

This refers to the Western medical approach, also known as the “disease-based model,” which views illnesses as a result of a malfunction of the body’s biological mechanisms (Elío-Calvo, 2023). Healthcare professionals in this system focus on diagnosing and treating health conditions, mainly through medication, surgery, and other procedures that are supported or validated scientifically.

As described above, the Western medical system is based on understanding the human body through biology, anatomy, and physiology, with a more curative than preventive approach. Although it can be highly effective in treating many diseases, it often overlooks emotional, social, or spiritual aspects of health that other medical systems take into account.

- **Intercultural Health**

This is an interaction between healthcare-disease perspectives from different medical systems (Aguilar-Peña et al., 2020). It is also considered a subfield of public health and a starting point for public policy development. According to Almeida and Almeida (2014), actions carried out within the ambit of intercultural health focus on rationalizing healthcare practices, promoting health, preventing disease, and strengthening traditional medicine.

In this context, intercultural health strategies aim to promote coordination between actors in traditional and biomedical systems, valuing and optimizing the work of each, in order to reduce inequalities in healthcare access and quality both within indigenous communities and in wider society (Chávez et al., 2015).

METHODOLOGICAL FRAMEWORK OF THE STUDY

STUDY AREA

The study was carried out on the shoreline of the Amazon River, between the municipalities of Leticia and Puerto Nariño (Figure 1). A partnership was established with the indigenous community of Puerto Esperanza, which is located 63 km from Leticia and comes under the administrative jurisdiction of Puerto Nariño. The community has a population of 596 people, who form 136 families.

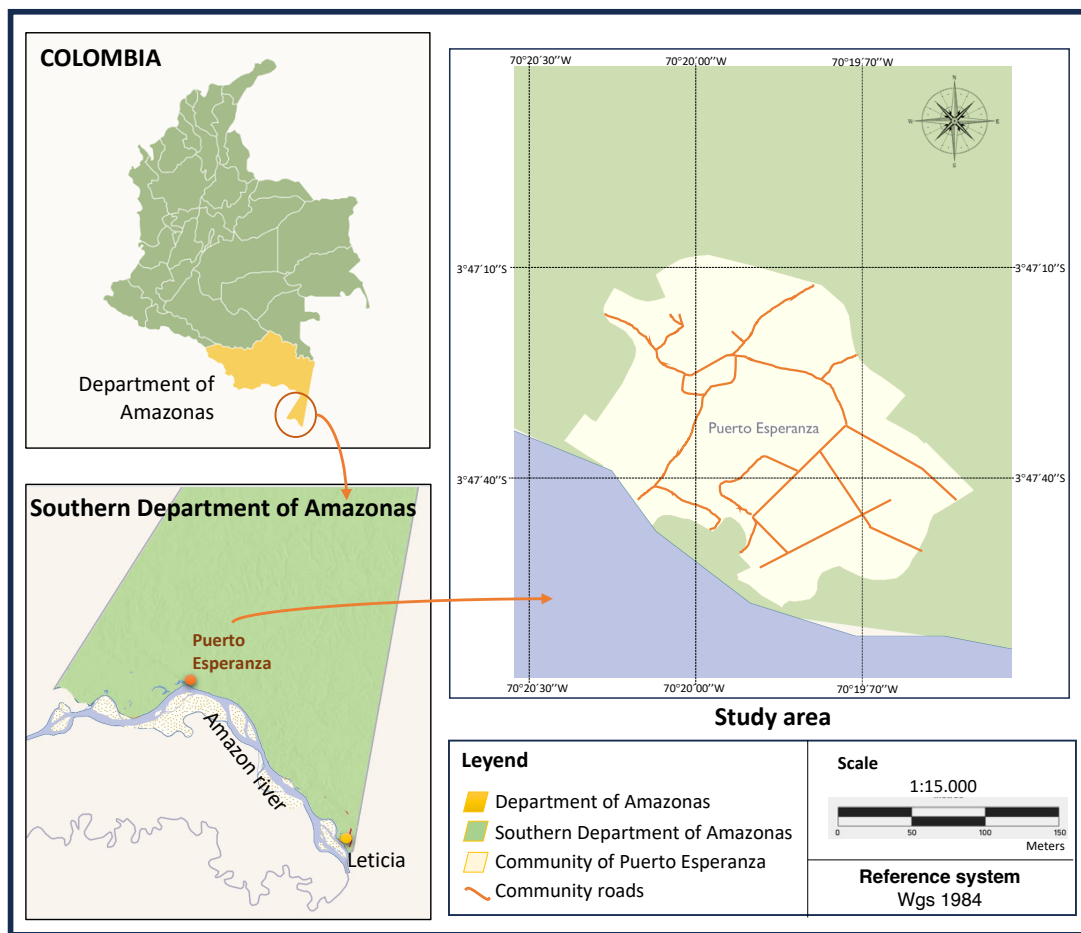


Figure 1. Study area

It is important to note that the indigenous communities of the Department of Amazonas are organized into Associations of Traditional Indigenous Authorities (AATIs, in its initials in Spanish). These bodies are responsible for implementing, in partnership with local, regional and national authorities, projects in areas such as health, education, and housing. The AATI

that works with the community of Puerto Esperanza is the Ticuna, Cocama, and Yagua Association (ATICOYA).

COMMUNITY CHARACTERIZATION

The indigenous community of Puerto Esperanza self-identifies as part of the Tikuna (Magüta) people, which is the largest indigenous group in the region. The Tikuna inhabit territories along the banks of small rivers that flow into the Amazon, and their population is spread over Brazil, Peru and Colombia, with around 27% estimated to live in the last of these countries (Rengifo et al., 2017). Like many other Amazonian indigenous communities, the inhabitants of Puerto Esperanza perform traditional subsistence activities such as fishing, hunting, the use of secondary forests (known locally as *rastrojos*), and cultivation in areas known as *chagras* (Vieco, 2015).

Due to the increasing integration of Amazonian communities into the market economy, their productive system has gradually incorporated commercial activities, particularly those related to tourism. As noted by Ochoa-Zuluaga (2019), this has been the most dynamic sector in the region over the past 15 years. The Tikuna community contributes in this regard by supplying food ingredients, notably cassava, chili peppers, and plantains, used by restaurants and hotels in Puerto Nariño.

METHODOLOGICAL PHASES

The research is interdisciplinary, encompassing socio-cultural, botanical, and ecological aspects (Figure 2). It has a mixed-methods or multi-method design, which utilizes a set of qualitative and quantitative tools that vary depending on the requirements needed to achieve each specific objective.

This study consisted of four methodological phases, based on an intercultural approach: 1) categorization and identification of social actors; 2) fieldwork; 3) laboratory work; and 4) data analysis.

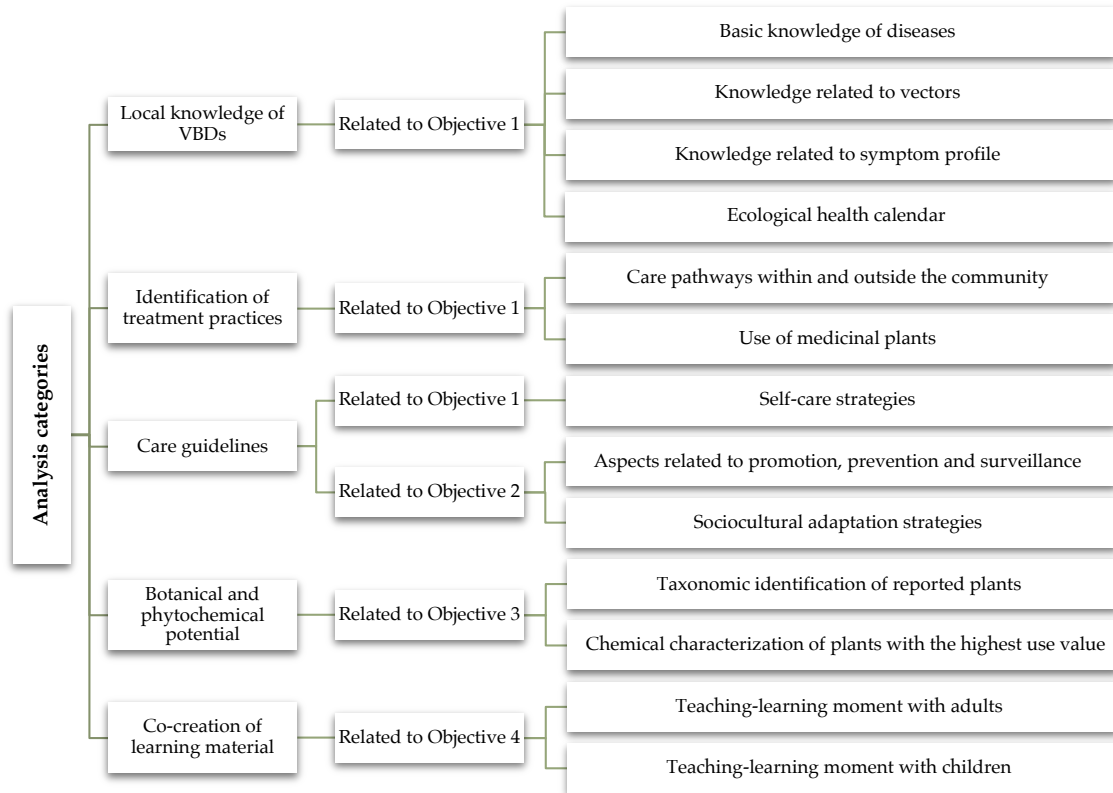


Figure 2. Sociocultural, botanical and ecological aspects of the study

• Categorization and Identification of Social Actors

In this phase, social actors were categorized into two main population groups: community-based and state-based. From the community category, the following actors were included in the study:

- Community actors for VBD management: people from the Puerto Esperanza community who can carry out self-care practices and who are beneficiaries of the Programs for the Promotion, Prevention, Control, and Elimination of VBDs and Zoonoses.
- Traditional medicine practitioners: knowledge keepers with community recognition, who use traditional medicine practices for the treatment of illnesses (they may self-identify as shamans, traditional healers, herbalists, prayer-leaders, midwives, etc)
- Associations of Traditional Indigenous Authorities (AATIs, according to their initials in Spanish): These associations, which include ATICOYA, have created a department responsible for coordinating issues related to traditional health. This group also carries out joint activities with the Departmental Health Secretariat and the Public Health Office of Puerto Nariño to implement various prevention and control programs.

Meanwhile, the following state actors were consulted:

- Biomedical system actors: Personnel from the Epidemiology and VBDs departments of the San Rafael Hospital in Leticia were contacted. Additionally, interviews were carried out with the health promoter from Puerto Esperanza, who is appointed by the Departmental Health Secretariat as a liaison for surveillance and control activities within the community, and with a person affiliated with the Colombia-Wisconsin One Health Consortium, which supports the study of febrile illnesses within the hospital.
- Departmental Health Secretariat: This branch of the Department of Amazonas government is responsible for promoting health and social health security plans, programs, strategies, and projects for inclusion in departmental and national-level activities. Personnel from the public health and VBD programs were contacted.
- Public Health Office: This forms part of the municipal authority and is responsible for implementing the public health programs set out in the municipality's territorial health plan. Personnel from the SIVIGILA (the national public health surveillance system) and the vector-borne diseases program areas were contacted.
- Health service providers: Most of the indigenous population is affiliated on a subsidized basis with the health service providers Mallamás or Nueva EPS. Therefore, representatives of these organizations were contacted for this study.

• Field work

With the social actors, three qualitative data collection techniques were used: semi-structured interviews, workshops, and door-to-door surveys. Semi-structured interviews were carried out with traditional medicine practitioners, biomedical system agents, the ATICOYA health coordinator, and officials from the Departmental Health Secretariat and the public health departments of the healthcare providers (Mallamás and Nueva EPS).

Traditional medicine practitioners were asked about their experience and awareness of types of VBDs (malaria, dengue, Chagas disease, and leishmaniasis), symptoms, patient care, and diagnostic and treatment practices. Additionally, they were asked about dosage, contraindications, and dietary requirements when using medicinal plants. Meanwhile, the interviews with biomedical system agents and officials from the various health authorities focused on institutional activities to implement VBD prevention and control campaigns, surveillance plans and protocols, sociocultural adaptation strategies, and the progress achieved or limitations experienced with these activities.

Several workshops were held with community members and officials from state institutions, where activities were carried out to identify social actors and their role in the management of

vector-borne diseases (VBDs), to collaboratively create an eco-health calendar, and to develop teaching and learning spaces for adults and children.

To understand the role of different social actors in the management of vector-borne diseases, a dialogue space was created for community members and representatives from institutions, namely the Departmental Health Secretariat, the Universidad Nacional de Colombia, and the Colombia-Wisconsin One Health Consortium. Through this, institutions were able to describe their activities related to VBDs, and participants could share their experience and knowledge. This enabled a collective understanding of progress made and limitations in VBD promotion and prevention in indigenous communities.

In the collaborative creation of the eco-health calendar, a range of factors were taken into account. Ecological factors included changes in the water level of the Amazon River, rainy and dry seasons, and periods of increase and decrease in vector populations. Additionally, subsistence activities, such as the main periods for preparing and clearing cultivation areas known as chagras, planting, and harvesting, were taken into account, as well as cultural activities such as the main community celebrations. Finally, epidemiological aspects such as periods with the highest number of dengue and malaria cases, and increases in symptoms such as cough, fever, body aches, vomiting, and diarrhea were incorporated.

In addition to the above, a series of meetings was held with adults and children. These were divided into a learning phase and a teaching phase. For the learning phase with adults, information videos and images of vectors were used to help participants distinguish between different VBDs. Also, a dialogue space was created to discuss experiences of caring for individuals suffering from these diseases, the common names of the vectors in Spanish and in the Tikuna language, self-care practices, areas where vectors proliferate, and participants' perceptions of how VBDs affect the indigenous population. This space was fundamental for the acquisition of both traditional and academic knowledge about vector-borne diseases. Based on this knowledge, a teaching space was created in which community members shared their knowledge with others through presentations, a theatrical play, and visual materials with explanations in both Spanish and the Tikuna language.

The information acquired from the adults was fundamental in informing the educational materials used in the learning sessions with children aged 9 to 14, which included information videos, storytelling activities, and the interactive game "vector race." Additionally, the teaching phase focused on developing a communication strategy whereby the children created messages about the prevention and management of vector-borne diseases that were appropriate to the communication channels and types of audiences identified within the community. This was done in partnership with community members, who participated in all activities conducted with the children.

With the support of the health promoter and other community representatives, door-to-door visits were carried out where one member of the household was asked to complete a questionnaire. Through this activity, information was acquired on the level of knowledge of VBDs in the community, the medicinal plants used for self-care, and the housing conditions

that could contribute to the proliferation of vectors. Additionally, a social mapping exercise was carried out with traditional medicine practitioners and other community members (Figure 3), during which 45 medicinal plants used to treat symptoms of vector-borne diseases were identified and located.

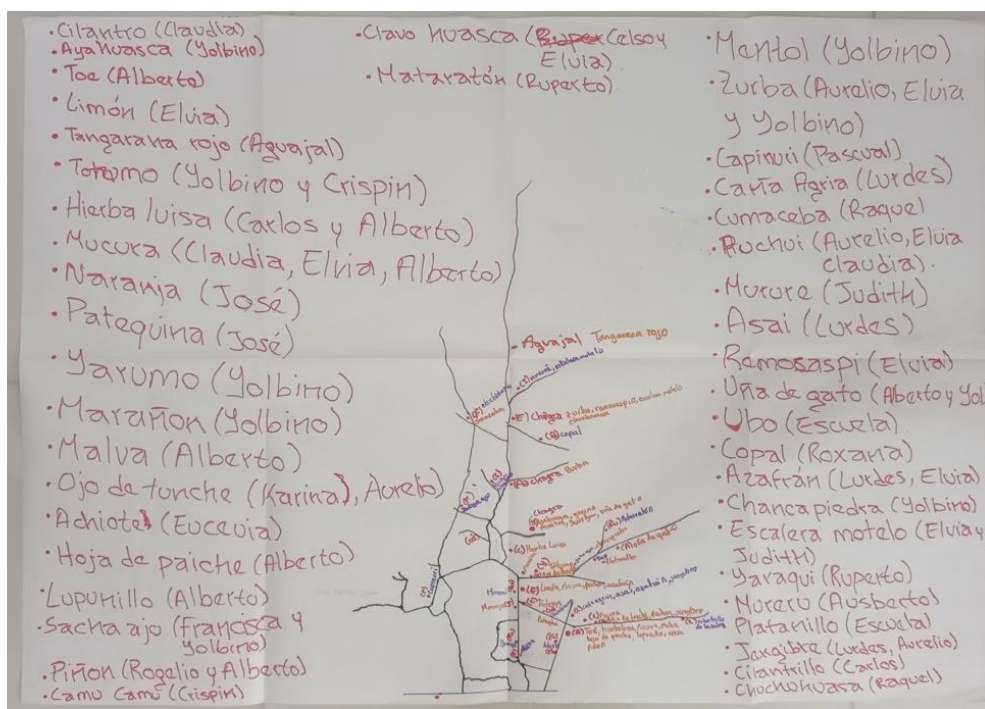


Figure 3. Social mapping of medicinal plants in Puerto Esperanza

Subsequently, field visits were conducted with traditional medicine practitioners to identify and collect samples of medicinal plants, recording their geolocation and taking photographs (Figure 4). The land type in which each species grows - (secondary forest, known as rastrojos, cultivated areas (chagras) or home gardens (solares) - was also recorded, as well as the method of extraction of the plant part used for medicinal purposes. In addition, it was determined whether each plant is native to the Amazon region or originates from elsewhere.

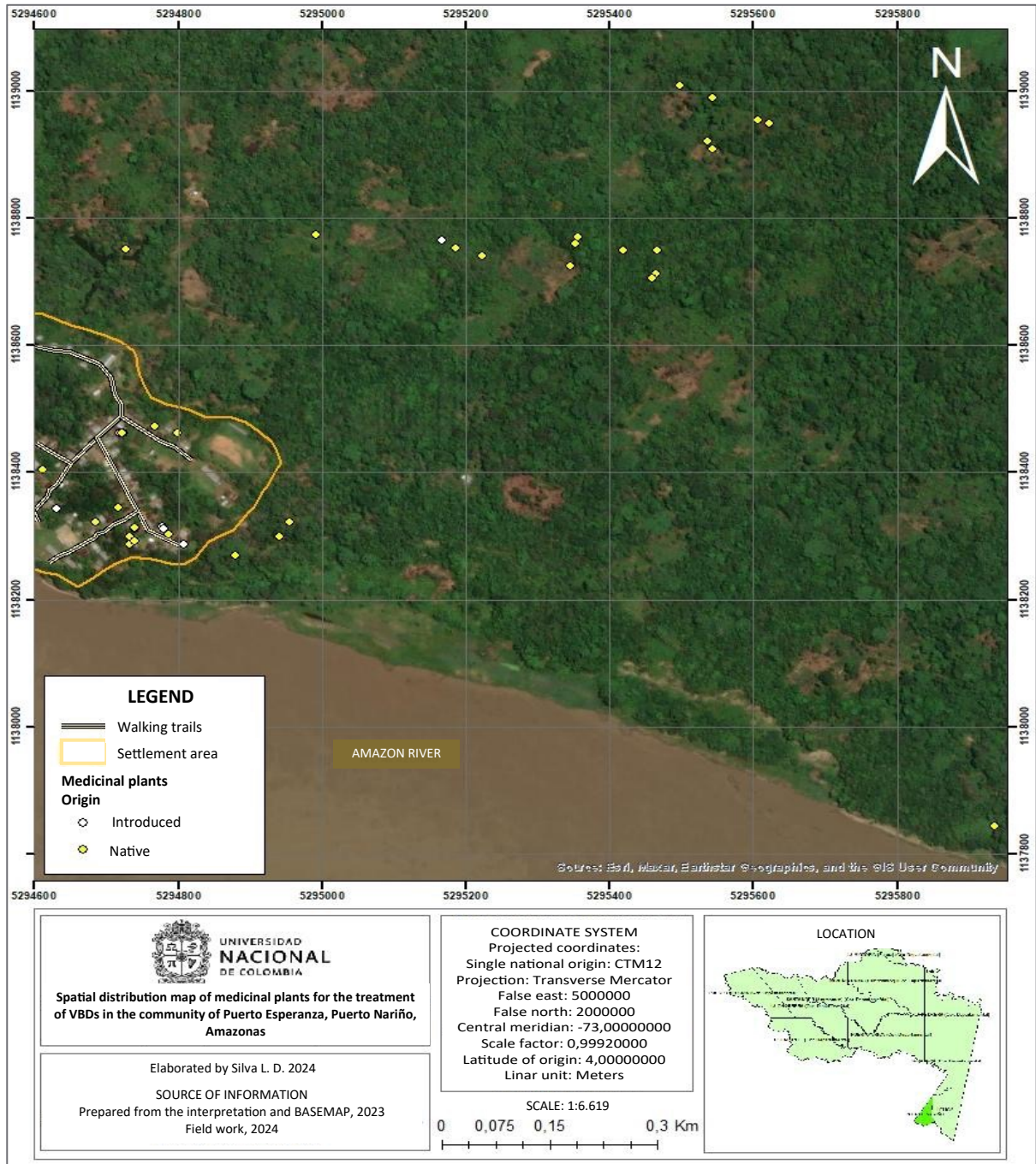


Figure 4. Geolocation map of medicinal plants

• Laboratory work

Plant samples were collected, mounted and dried following the methodology of Arnelas et al. (2012), and the specimens were sent to the Gabriel Gutiérrez Villegas Herbarium at the Universidad Nacional de Colombia, Campus Medellín, for taxonomic identification.

Additionally, five botanical samples were taken to the Faculty of Pharmacy at the Universidad Nacional de Colombia, Campus Bogotá, for chemical characterization of their extracts. These were: remocaspi (*Aspidosperma excelsum*), clavo huasca (*Tynanthus panurensis*), zurba or cow tree (*Couma macrocarpa*), totumo or calabash (*Crescentia cujete*), and ubo or hog plum (*Spondias mombin*).

• Data Analysis

Initially, a code tree was developed to categorize the information obtained from both community and institutional actors during the workshops and semi-structured interviews (Table 1). Additionally, the software ATLAS.ti 24.2.0 was used for the coding and systematic analysis of the qualitative data.

Table 1. Code tree for qualitative data analysis

Code	Subcode
C1. Local knowledge of VBD	SC1. Knowledge of diseases SC2. Knowledge of vectors SC3. Symptom profile
C2. Concepts regarding medical systems	SC4. Coordination of medical systems SC5. Traditional medical system SC6. Biomedical system
C3. Treatment practices	SC7. Care pathways SC8. Use of medicinal plants
C4. Care guidelines	SC9. Self-care practices SC10. Prevention, control and surveillance

Descriptive statistics were used to estimate the level of local awareness about vector-borne diseases, the presence of species in different types of land types, the plant part used, and the methods of preparation and administration. To analyze the data, quantitative ethnobotanical parameters were employed, namely the TRAMIL Significant Use Level (NUST), the Relative Frequency of Citation (RFC), and the Use Value (UV) of species.

The TRAMIL Significant Use Level (NUST) refers to the medicinal uses of each vegetable species cited by the people surveyed about disease treatment. This is calculated according to the formula of Monganas and Trujillo (2024):

$$NUST = \frac{Us}{N} \times 100$$

Where "Us" is the number of citations of the species and "N" is the number of respondents surveyed. A frequency of $\geq 20\%$ is considered significant in terms of cultural acceptance.

The Relative Frequency of Citation (RFC) was estimated in order to show the popularity of the different plant species among traditional practitioners. This index was calculated using the formula of Tardío and Pardo-de Santayana (2008):

$$FRC = \frac{FC}{N}$$

Where "RFC" is the Relative Frequency of Citation, "FC" is the number of respondents who mention a given plant species, and "N" is the total number of traditional medicine practitioners surveyed. A value ≥ 1 is obtained when a large number of respondents mention a particular species.

The Use Value of Species (UVs) was calculated to determine the relative importance of each plant species used by traditional practitioners, following the formula of Phillips and Gentry (1993):

$$VUs = \frac{Us}{N}$$

Where "Us" is the number of uses mentioned for a given species and "N" is the total number of traditional medicine practitioners interviewed. The use value of a species is an effective index for determining which plants are considered most useful by a given group of people.

CHAPTER I. KNOWLEDGE OF VECTOR-BORNE DISEASES IN PUERTO ESPERANZA

In many indigenous communities, “integral” health and well-being are understood as a dynamic balance between the biological, social, psychological, and spiritual dimensions of the life of the individual and that of the group. In this sense, health is based on the harmony between human beings and nature, which includes plant and animal life (Zuluaga, 1999). Diseases represent states of imbalance and, depending on local knowledge and practices, environmental influences, the actions of other people, or unsatisfactory personal relationships may be considered causes.

These concepts influence people’s perception of health and disease treatment and, consequently, shape the practices of traditional healthcare and preventive care. The following section describes the main demographic aspects of the community of Puerto Esperanza, as well as knowledge related to vector-borne diseases, including their common names, vector identification, and symptom recognition.

DEMOGRAPHIC ASPECTS

The community actors involved in the management of vector-borne diseases who participated in the door-to-door surveys were classified into four groups, as shown in Table 2. Of the respondents, 55% were women and most were between 26 and 50 years of age. Inhabitants of Amazonian indigenous communities do not typically have formal employment and often depend on agriculture for subsistence (Meisel et al. 2013). Some occasionally engage in other subsistence activities such as fishing and hunting, without pursuing a specific occupation.

Additionally, it was found that older adults have had more limited access to formal education, as some had not learned to read and/or write, and most had not been able to finish primary school. The younger population has had the opportunity to attain a higher level of education, and significant numbers of them have completed secondary school; however, only a few have chosen to continue studying to university level.

Table 2. Sociodemographic characteristics of the respondents

Category	Variables	No. surveyed	Frequency (%)
Gender	Female	30	55
	Male	24	45
Age	≤ 25	11	20
	26-50	23	42
	51-75	19	35
	≥ 76	1	3
Occupation	Agriculture	37	69
	Construction	3	6
	Fishing	2	4
	School-teaching	1	2
	Other formal employment	4	7
	Other occupations	7	13
Academic level	Illiterate	3	6
	Incomplete primary	15	28
	Complete primary	8	15
	Incomplete secondary	11	20
	Complete secondary	12	22
	Technical	4	7
	Undergraduate	1	2

BASIC KNOWLEDGE OF VBDs AND THEIR VECTORS

The people of Puerto Esperanza are not unfamiliar with vector-borne diseases; 91% of respondents have heard of these diseases, and more specifically, 65% stated that they know them to be transmitted by insect bites, while 89% consider them to be a health problem for their community. As shown in Figure 5, malaria and dengue are the diseases most frequently identified by the population, followed by yellow fever. In the case of malaria, this is known to some respondents by the common names “paludismo” or “terciana.”

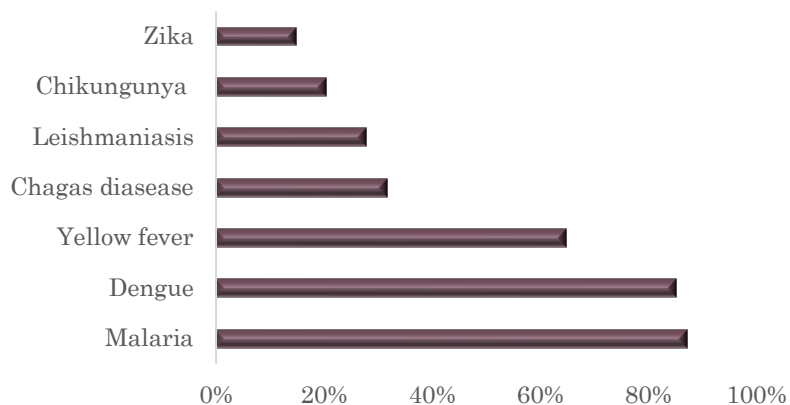


Figure 5. Frequency of identification of vector-borne diseases

It is likely that the high level of awareness of these diseases within the community is due to their prevalence in the region. In 2023, the Department of Amazonas reported the highest incidence of dengue cases in Colombia, with 1,926.4 cases per 100,000 inhabitants (MinSalud, 2023). Moreover, Guhl et al. (2020) emphasized that indigenous populations in this department are highly exposed to dengue and malaria, particularly during the months of July and September, when the number of infected individuals tends to increase. Other VBDs, such as Chagas disease and leishmaniasis, are not frequently recognized, which may be due to the fact that these diseases tend to be underdiagnosed in Colombia (Padilla et al., 2017).

Although most people in the community are familiar with the concept of vector-borne diseases, only 38% can name the insect vectors and symptoms specific to each disease. This finding supports what was reported by Pineda and Agudelo (2005), who found that various indigenous groups in the Department of Amazonas, including the Tikuna population, have a limited ability to differentiate between the symptoms of malaria, dengue, and yellow fever, as well as their respective vectors. Moreover, members of the community who took part in this study associated symptoms such as fever, headache, vomiting, chills, anemia and loss of appetite with malaria.

In the dialogue spaces with community members, it was observed that many consider the term “vector” as technical and difficult to recognize or explain, which is why VDBs are commonly referred to as “diseases transmitted by mosquitoes.” This, in turn, shows that the primary mode of transmission they recognize is mosquito bites, although they are not able to distinguish between the dengue (*Aedes* sp.) and malaria (*Anopheles* sp.) vectors.

Other types of vectors, such as *Lutzomyia* and triatomines, are not easily identified by the community and, therefore, are not usually correctly associated with the diseases they transmit. During learning and knowledge exchange sessions, it was observed that “la llaga” (the sore) may be a common name used to identify leishmaniasis, given the description by participants of an ulcer-like sore seemingly linked to cutaneous leishmaniasis. Meanwhile, participants associated triatomines with the words “chinche” or, more commonly, “pito,” and many believed that these vectors were responsible for causing “la llaga,” but did not recognize them as transmitters of Chagas disease. This was also noted in other communities by an officer of the Departmental Health Secretariat:

“In the case of leishmaniasis and Chagas, we have found in many communities that there is misinformation or a lack of knowledge, or they confuse the two, thinking, for example, that the sore caused by leishmaniasis is produced by the pito, and so this leads to people not protecting themselves against one of the two diseases, or doing so in the wrong context.”

People tend to be aware of some of these diseases because they hear others in the community talk about general symptoms, know individuals who have been infected, or are visited by health institution workers carrying out door-to-door promotion and prevention campaigns. As a result, people often assume symptoms such as headache, chills or “shivering,” fever, nausea and body aches are due to malaria. Other symptoms, like rashes, are frequently

confused with those of dengue, and people are unable to identify which symptoms are directly related to leishmaniasis or Chagas disease:

“They can’t tell the difference between dengue and malaria. So, they just say, ‘a mosquito bit me,’ and that’s it. They don’t recognize the vector. In some cases, they don’t know why they are sick; but they repeat what they hear others say. So, if someone else says they have a headache, then they say they have a headache too. If one has muscle pain, the other one says they do too. In indigenous communities, especially, they tend to mimic each other. If one person has malaria, then another says they have malaria too. So, they turn up to the consultation saying, ‘I have malaria.’ That is, despite nothing having been diagnosed, they arrive with a diagnosis because they heard someone else had malaria, but that might not be the case - it could be something else.” (Health worker, IPS Mallamás).

Despite the possible confusions described above regarding vector-borne diseases, it is important to note that the knowledge exchange spaces in Puerto Esperanza have played a significant role in building a collective understanding of disease and vector identification, especially when approached from an inclusive and culturally respectful perspective.

CHAPTER II. DIVERSITY OF MEDICINAL PLANTS USED FOR THE MANAGEMENT OF VECTOR-BORNE DISEASES

Medicinal plants have been used for centuries by cultures around the world as a natural treatment for various ailments and diseases. They tend to contain a variety of active compounds that provide therapeutic benefits, which makes them effective in treating a wide range of symptoms and illnesses. In traditional medicine, these plants play a fundamental role in maintaining people's health and well-being. For this reason, valuing and preserving the knowledge held by indigenous people on the use of medicinal plants is essential in order to ensure their continuity and benefits for future generations.

In the following section, we present the main medicinal plants used in Puerto Esperanza for the management of vector-borne diseases, selecting those with a high Significant Use Level according to TRAMIL (NUST). We also describe the land types where they grow and their origin (native or introduced).

MEDICINAL PLANTS USED FOR VBDs IN PUERTO ESPERANZA

Medicinal plants play a crucial role in the management of vector-borne diseases, as many of them contain chemical compounds that can act directly against the microorganisms that cause these diseases, alleviate their symptoms, or function as natural repellents or insecticides. In the community of Puerto Esperanza, 45 plants, grouped into 29 families, are prioritized for their medicinal value, and in most cases, are considered useful in the treatment of various symptoms related to VBDs.

In Table 3 information on medicinal plants is summarized, including the common names of the species in English and in the Tikuna language, as well as the land types and the uses associated with them. When selecting the plants to study, it was observed that most members of the community recognize and classify them mainly using their Spanish names and are able to distinguish plant species with similar morphological characteristics.

From a taxonomic perspective, Bignoniaceae was identified as the dominant family, with four species, followed by Anacardiaceae, Rubiaceae, and Zingiberaceae, each with three species. Other families had two species, including Asteraceae, Apocynaceae, Euphorbiaceae, Rutaceae, and Moraceae.

Table 3. Plant species identified for the management of VBDs in Puerto Esperanza

Family/ Scientific name	Common name	Tikuna Name	Type of Land type	Uses related to VBDs Symptoms	NUST
Anacardiaceae					
<i>Anacardium occidentale</i> L.	Marañón (Cashew)	coü	Home gardens (solar)	Anemia, diarrhea, headache, skin ulcers	3.28
<i>Spondias mombin</i> L.	Ubo (Hog plum)	yomeru	Floodplain secondary forest (rastroy)	Anemia, bloody stools, diarrhea, bleeding, intestinal colic, rash, vomiting	3.28
<i>Spondias dulcis</i> Parkinson	Matarratón (Golden apple)	ünca arw dairü	Home gardens (solar)	Fever, insect bites, skin ulcers	1.64
Apiaceae					
<i>Eryngium foetidum</i> L.	Cilantro	chicuri	Upland cultivation area (chagra)	Heart conditions, intestinal colic, liver conditions	4.92
Apocynaceae					
<i>Aspidosperma excelsum</i> Benth.	Remocaspi	ñomane	Upland secondary forest (rastroy)	Dengue, fever, malaria	6.56
<i>Couma macrocarpa</i> Barb. Rodr.	Zurba (Cow tree)	nge'chi	Upland secondary forest (rastroy)	Anemia, diarrhea, headache	1.64
Araceae					
<i>Dieffenbachia</i> Schott	Patequina (Dumb cane)	cheriwa	Home gardens (solar)	Body aches, insect bites, wounds	3.28
Areaceae					
<i>Euterpe oleracea</i>	Asai palm	waira	Upland secondary forest (rastroy)	Anemia, bloody stools, intestinal colic	11.48
Asteraceae					
<i>Pseudelephantopus spiralis</i> (Less.) Cronquist	Cilantrillo (Spiral dog's- tongue)	chicurichikü	Upland secondary forest (rastroy)	Anemia, fever, headache, high blood pressure, wounds	4.92
<i>Tagetes erecta</i> L.	Hoja de Tunche (African marigold)	na'chiatü arw ngeün	Home gardens (solar)	Body aches, fever, headache, vomiting	13.11
Bignoniaceae					
<i>Mansoa standleyi</i> (Steyerm.) A.H. Gentry	Sacha Ajo (Sacha garlic)	own	Floodplain secondary forest (rastroy)	Diarrhea, fever, headache, seizures, skin ulcers, used as repellent	44.26
<i>Crescentia cujete</i> L.	Totumo (Calabash)	ngawe	Home gardens (solar)	Diarrhea, fever, headache, malaria, rash	13.11
<i>Tanaecium affine</i> (A.H. Gentry) L.G. Lohmann	Tapahuillo (Afine Tanaecium)	cacochikw	Upland secondary forest (rastroy)	Wounds, stomach pain	1.64
<i>Tynanthus panurensis</i> (Bureau) Sandwith	Clavo huasca	clavo huasca	Upland secondary forest (rastroy)	Body aches, chills, fever, headache, kidney conditions, used for cleaning blood vessels	3.28

Continue Table 3

Family/ Scientific name	Common name	Tikuna Name	Type of Land type	Uses related to VBDs Symptoms	NUST
Bixaceae					
<i>Bixa orellana</i> L.	Achiote (Annatto)	ütá	Home gardens (solar)	Body aches, chills diarrhea, used as repellent	6.56
Burseraceae					
<i>Protium nitidifolium</i> (Cuatrec.) Daly	Copal	cha're	Upland secondary forest (rastroyo)	Used as repellent	1.64
Caryophyllaceae					
<i>Drymaria cordata</i> (L.) Willd. ex Schult.	Yaraqui (Tropical chickweed)	butunchikwü	Home gardens (solar)	Diarrhea, gastritis, intestinal colic, skin ulcers	4.92
Celastraceae					
<i>Maytenus laevis</i>	Chuchuhuasa	chuchuhuasa	Upland secondary forest (rastroyo)	Body aches, diarrhea, gastritis, intestinal colic, skin ulcers	4.92
Costaceae					
<i>Costus scaber</i> Ruiz & Pav.	Caña agria (Spiral ginger)	ngobuya	Upland secondary forest (rastroyo)	Kidney conditions, respiratory problems	1.64
Crassulaceae					
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Hoja de Paiche (Cathedral bells)	de'chiatü	Home gardens (solar)	Wounds	1.64
Euphorbiaceae					
<i>Euphorbia cotinifolia</i> L.	Lupunillo (Caribbean copper plant)	wochinechik ü	Home gardens (solar)	Body aches	1.64
<i>Jatropha gossypifolia</i> L.	Piñón (Bellyache bush)	pion	Upland secondary forest (rastroyo)	Body aches, diarrhea, fever	1.64
Fabaceae					
<i>Schnella guianensis</i> (Aubl.) Wunderlin	Escalera de motelo	ngobü arw töone	Upland secondary forest (rastroyo)	Anemia, fever, wounds, used for healing properties	3.28
<i>Swartzia polyphylla</i> DC	Cumaceba (Apamate)	cumachiwa	Upland secondary forest (rastroyo)	Respiratory problems	3.28
<i>Machaerium kegelii</i> Meisn.	Uña de gavilán (Legume)	rw inyü patü	Upland secondary forest (rastroyo)	Bloody stools, diarrhea	1.64
Iridaceae					
<i>Eleutherine bulbosa</i> (Mill.) Urb.	Ruiseñor (Tears of the virgin)	puchui	Home gardens (solar)	Hemorrhage	3.28
Malpighiaceae					
<i>Banisteriopsis caapi</i> (Spruce ex Griseb.) C.V. Morton	Ayahuasca	ayahuasca	Floodplain secondary forest (rastroyo)	Fever, headache, stomach pain	1.64
Malvaceae					
<i>Malachra ruderalis</i> Gürke	Malva	malva	Home gardens (solar)	Body aches, diarrhea, headache	6.56

Continue Table 3

Family/ Scientific name	Common name	Tikuna Name	Type of Land type	Uses related to VBDs Symptoms	NUST
Moraceae					
<i>Brosimum Acutifolium</i>	Murure	murure	Floodplain secondary forest (rastroy)	Body aches	4.92
<i>Pseudolmedia laevis</i> (Ruiz & Pav.) J.F. Macbr.	Capinuri (Goat's milk tree)	copumari	Upland secondary forest (rastroy)	Wounds, tumors	1.64
Myrtaceae					
<i>Myrciaria floribunda</i> (H. West ex Willd.) O. Berg	Camu camu (Guavaberry)	como como	Floodplain secondary forest (rastroy)	Heart conditions	1.64
Petiveriaceae					
<i>Petiveria alliacea</i> L.	Múcura (Guinea hen weed)	ngowaatü	Home gardens (solar)	Body aches, fever, headaches, intestinal colic, seizures	50.82
Phyllanthaceae					
<i>Phyllanthus niruri</i> L.	Chancapiedra	nuta arw chaichirü	Upland cultivation area (chagra)	Fever, gastritis, kidney conditions, liver conditions	3.28
Poaceae					
<i>Cymbopogon citratus</i> (DC.) Stapf	Hierba Luisa (West Indian lemongrass)	naiyüatü	Home gardens (solar)	Dengue, fever, headache, Muscular weakness, vomiting	9.84
<i>Triplaris weigeltiana</i> (Rchb.) Kuntze	Tangarana rojo (Long jack)	conüwa daukü	Upland cultivation area (chagra)	Diarrhea, fever, headache, stomach ache	3.28
Rubiaceae					
<i>Coussarea brevicaulis</i> K. Krause	Chanango	chanango	Upland secondary forest (rastroy)	Fever	1.64
<i>Faramaea capillipes</i> Müll. Arg.	Mentol	mentol	Upland secondary forest (rastroy)	Fever, headache	11.48
<i>Uncaria guianensis</i> (Aubl.) J.F. Gmel.	Uña de gato roja (Cat's claw)	michi patü daukü	Floodplain secondary forest (rastroy)	Bloody stools, body aches, hemorrhages, infections, wounds	3.28
Rutaceae					
<i>Citrus latifolia</i> Tanaka ex Q. Jiménez	Limón (Lime)	irumawa	Home gardens (solar)	Bloody stools, body aches, fever, headache	34.43
<i>Citrus sinensis</i> (L.) Osbeck	Naranja (Orange)	naraña	Home gardens (solar)	Body aches, fever, dolor de cabeza, nausea	11.48
Solanaceae					
<i>Brugmansia</i> Pers.	Toe (Angel's trumpets)	toe	Home gardens (solar)	Wounds	1.64
Urticaceae					
<i>Cecropia ficifolia</i> Warb. ex Snethl.	Yarumo	omaü wa	Upland secondary forest (rastroy)	Bloody stools, diarrhea, fever	3.28

Continue Table 3

Family/ Scientific name	Common name	Tikuna Name	Type of Land type	Uses related to VBDs Symptoms	NUST
Zingiberaceae					
<i>Curcuma longa</i> L.	Azafrán (Turmeric)	de'pan	Home gardens (solar)	Heart conditions, intestinal colic	1.64
<i>Renealmia alpinia</i> (Rottb.) Maas	Platanillo	poichikw	Upland secondary forest (rastroy)	Headache, muscular weakness	1.64
<i>Zingiber officinale</i> Roscoe	Ajengibre (Ginger)	techiwa	Upland secondary forest (rastroy)	Bloody stools, body aches, diarrhea, nausea	3.28

The plant commonly known as guinea hen weed (*Petiveria alliacea*) has the highest level of medicinal use among people in the community, with an NUST of 50.82. This is followed by the plant commonly known in Spanish as “sacha ajo” (*Mansoa standleyi*) with 44.26, and lime (*Citrus latifolia*) with 34.43. Sasha ajo, annatto (*Bixa orellana*) and copal (*Protium nitidifolium*) were identified as being used in repellents, especially against mosquito bites.

Martins et al. (2000), Araujo et al. (2016), and Lawal et al. (2024) have reported similar medicinal applications for guinea hen weed to those found in this study, including in the treatment of seizures, pain, and skin and gastrointestinal infections, and as an insecticide. However, although this plant has been reported to have antiprotozoal and antimalarial properties (Cáceres et al. 1998, Gbenga & Oluyemisi 2019), in Puerto Esperanza it was not identified as being used directly for the treatment of diseases such as malaria.

DISTRIBUTION OF PLANT SPECIES

Within the community, the areas where the plants prioritized for the management of vector-borne diseases grow were categorized into four types of land (Figure 6). Most of the species were found in home gardens, commonly known as solares, and in upland secondary forests (rastroy in Spanish or ichikü dauchitacü in the Tikuna language). The rest were located in lowland secondary forests (ichikü nibaiü) and in upland cultivation areas or chagras (nãane dauchitacü).

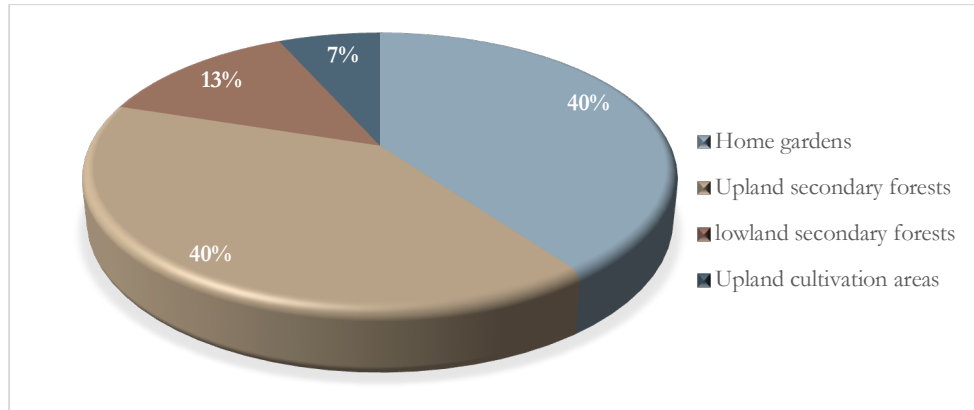


Figure 6. Distribution of plant species for VBD treatment by land type

Many of these plant species, such as *Bixa orellana* (annatto), *Malachra ruderalis* (malva), *Spondias dulcis* (golden apple), *Eleutherine bulbosa* (tears of the virgin), and *Petiveria alliacea* (guinea hen weed), were found in the solares (home gardens) of traditional medicine practitioners. These individuals intentionally cultivate certain plant species in medicinal gardens at their homes, thereby ensuring they are available for the preparation of remedies.

According to Garzón (2023), the local classification of the land type in the southern Colombian Amazon region is informed by the recognition of specific geographic areas, flooding frequency, vegetation cover, historical land use, soil types, and predominant animal species. For example, *Eryngium foetidum* (cilantro) and *Phyllanthus niruri* (chancapiedra) are species commonly identified as being grown for medicinal or culinary purposes in the cultivation areas known as chagras, and need to be planted in dry or elevated areas for optimal growth.

Other plants such as *Maytenus laevis* (chuchuhuasa), *Pseudolmedia laevis* (goat's milk tree), *Schnella guianensis* (escalera de motelo) and *Aspidosperma excelsum* (remocaspi) have been identified as wild species (Rai et al. 2021) and are usually found in the upper areas of secondary forests. Considering that 53.3% of the plants prioritized by the community are located in stubble, it can be affirmed that wild species have a high relevance in the traditional medicine of Puerto Esperanza.

Regarding the origin of the species prioritized by the community, six were identified as having been introduced into the Amazon territory: *Zingiber officinale* (ginger), *Tagetes erecta* (African marigold), *Curcuma longa* (turmeric), *Cymbopogon citratus* (West Indian lemongrass), *Kalanchoe pinnata* (cathedral bells) and *Spondias dulcis* (golden apple). Ginger, turmeric, lemongrass, and golden apple are known to originate from Southeast Asia (Zambrano-Blanco, 2015; Gulati et al., 2021; Soto et al., 2002; Maldonado et al., 2005), while African marigold comes from Central America (Cicevan et al., 2023), and cathedral bells from tropical Africa and Madagascar (Stevens et al., 2001).

These plant species have been introduced to the Amazon in various ways, mainly through human activity. This indicates that, over the centuries, indigenous communities in the region have played a fundamental role in the dispersal and cultivation of these plants, adapting them

to their cultural, medicinal, and dietary needs. Given that the interaction between indigenous communities and plant species has been key to the region's biodiversity, it is essential to consider community-based strategies for the conservation and sustainable harvesting of plants of importance in the management of vector-borne diseases.

CHEMICAL COMPOUNDS OF THE MEDICINAL PLANTS

The systematic study of chemical compounds present in medicinal plants traditionally used by indigenous communities represents a valuable opportunity for the development of new therapeutic alternatives against vector-borne diseases. These studies contribute to documenting and preserving traditional ethnobotanical knowledge, help establish a scientific basis for their medicinal use, and identify bioactive compounds with potential antiparasitic or insecticidal properties.

From a socioeconomic perspective, research into these medicinal plants can create economic development opportunities for local communities, improve access to treatments for vector-borne diseases, and reinforce the value attributed to indigenous traditional knowledge. This last aspect is particularly relevant given the growing resistance to conventional drugs, the need for accessible therapeutic alternatives, and the impact of vector-borne diseases on rural communities.

The chemical characterization of the species *remocaspi* (*Aspidosperma excelsum*), calvo huasca (*Tynanthus panurensis*), cow tree (*Couma macrocarpa*), calabash (*Crescentia cujete*), and hog plum (*Spondias mombin*) could reveal novel compounds with biological activity against vector-borne pathogens (Table 4). Previous studies have shown that *Aspidosperma excelsum* contains indole alkaloids with potential antiplasmodial activity (Grifoni & Rezende, 2023), *Tynanthus panurensis* presents phenolic compounds with anti-inflammatory properties (Chávez et al., 2017), *Crescentia cujete* possesses flavonoids and tannins with antimicrobial activity (Parvin et al., 2015), and *Spondias mombin* contains terpenes and phenolic compounds with antiparasitic properties (Pérez-Portero et al., 2016).

Flavonoids are compounds that are widely distributed in plants and play key roles in defense, acting as antioxidants and antimicrobials. In the resin of *Couma macrocarpa*, it is common to find bioactive flavonoids associated with protection against pathogens and environmental stress. Similarly, phenolic acids and their derivatives, which have the same biosynthetic origin as flavonoids, are common secondary metabolites in plants. These compounds possess antioxidant and antimicrobial properties, making them useful in defending against pathogens, herbivores, and adverse environmental conditions (Ávalos & Pérez-Urria, 2009).

Table 4. Secondary metabolites of the medicinal plants studied

Species Secondary metabolites	<i>Aspidosperma excelsum</i> (Bark)	<i>Aspidosperma excelsum</i> (Leaves)	<i>Tynanthus panurensis</i> (Bark)	<i>Spondias mombin</i> (Bark)	<i>Couma macrocarpa</i> (Resin)	<i>Crescentia cujete</i> (Fruit)
Alkaloids	Positive	Not determined	Negative	Negative	Negative	Negative
Flavonoids	Positive	Positive	Positive	Negative	Negative	Not determined
Steroids and/or terpenes	Positive	Positive	Positive	Positive	Positive	Positive
Coumarins	Positive	Positive	Not determined	Not determined	Negative	Negative
Phenolic compounds	Positive	Positive	Positive	Positive	Not determined	Not determined
Anthracenes	Negative	Negative	Negative	Not determined	Negative	Negative
Tannins	Not determined	Negative	Positive	Positive	Negative	Negative

Additionally, lupeol acetate plays a defensive role in plants and is frequently found in resins, waxes and latex. The presence of triterpenes is evident in the latex of *Couma macrocarpa*, supporting the likelihood that lupeol acetate is part of its composition (Roumy et al., 2020). Fatty acids and their derivatives, such as the detected compounds mentioned above, are typical products of lipid metabolic pathways in plants. These compounds are highly likely to be present in protective barriers such as latex, where they contribute both to chemical defense and to the functional structure.

Of the species analyzed, *Aspidosperma excelsum* is especially noteworthy, as this species has been associated with antiplasmodial activity in previous studies. The presence of characteristic alkaloids of this species was confirmed, which may explain its use by the community of Puerto Esperanza for the treatment of vector-borne diseases.

CHAPTER III. CHARACTERIZATION OF CARE PATHWAYS AND PRACTICES IN THE COMMUNITY

In rural Amazonian areas, a hybrid healthcare system has developed whereby traditional and Western medical practices coexist. People can choose between a doctor at the hospital or a traditional medicine practitioner, depending on their symptoms and the nature of the illness, whether caused by physical or spiritual factors (Jiménez et al., 2015). Indigenous people in the Department of Amazonas typically follow a three-stage care pathway (Garzón, 2022). The first stage is self-care, which is based on knowledge and social customs used by individuals to manage health issues. This includes the traditional practices and remedies employed to treat their symptoms and ailments or those of close family members.

When self-care has proven ineffective and more specialized treatment is needed, the pathway progresses to the second stage, with the involvement of a traditional medicine practitioner. Their extensive experience and acquired knowledge allow them to identify the nature of the illness and determine whether treatment can be limited to the use of medicinal plants. If it cannot, or if the patient seeks specific medical therapies or encounters complications, the pathway moves to the final stage with visits to hospitals or health centers.

Although the three-stage healthcare pathway provides a general framework for understanding care patterns in these communities, the sequence of the stages varies depending on the individual case (Garzón, 2022). In general, a stronger reliance on traditional medicine has been observed among members of indigenous communities in the Amazon, as a result of a combination of sociocultural perspectives, economic barriers, and limited access to the biomedical system (Brierley, 2014).

In this context, traditional medical practices and the use of plant species are widely recognized as the most readily available and cost-effective means for treating and preventing vector-borne diseases. This highlights the importance of protecting traditional knowledge on the use of medicinal plants as a cultural heritage and integrating this into modern medical practices (Maache et al., 2024). Below, the care pathway stages in Puerto Esperanza for managing vector-borne diseases are described from the perspective of the local population, traditional medicine practitioners, and health institution officials in the department.

SELF-CARE PRACTICES IN PUERTO ESPERANZA

This stage of the care pathway consists of a practice that has been passed down from generation to generation among the indigenous population and plays a fundamental role in managing vector-borne diseases. These communities have developed their own knowledge and strategies to prevent and treat various ailments, including traditional remedies, preventive methods, and cultural adaptations that support their well-being and help them face the challenges posed by these diseases.

The perspective of the community on self-care for VBDs is based on the identification of symptoms they perceive as common to these illnesses and the use of various plant species for home treatment. As shown in Figure 7, the main symptoms for which the prioritized species described in Chapter 2 are used are fever (20), headache (16), diarrhea (14), and body aches (14).

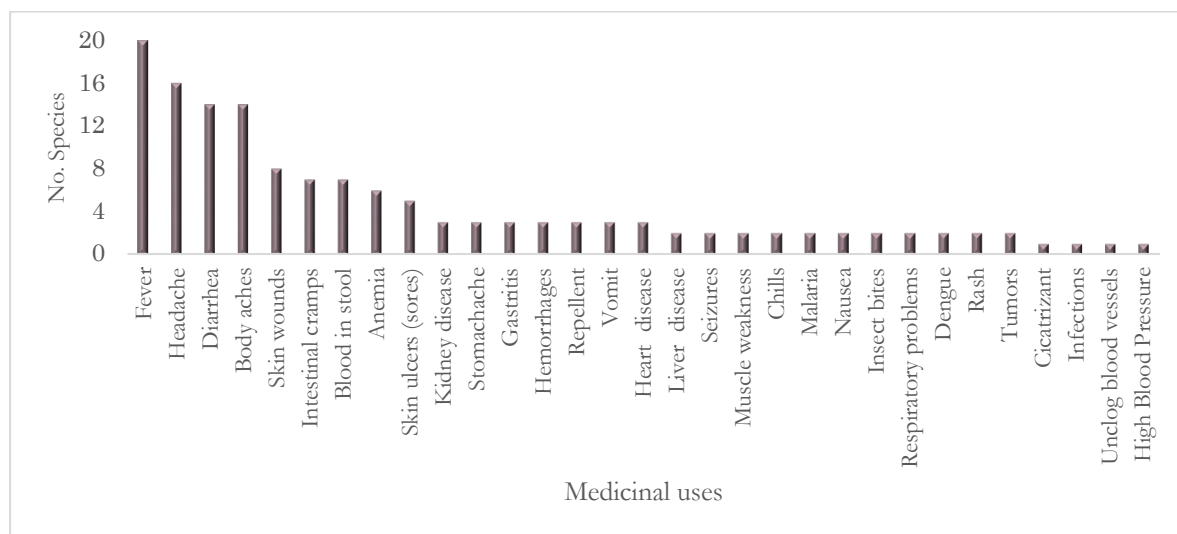


Figure 7. Number of genera and species used for the treatment of VBD symptoms

Although the people of Puerto Esperanza recognize some vector-borne diseases, there is a lack of knowledge regarding other plants that can be used for self-care in cases of dengue or malaria. This is evident from Table 5, which lists the plants used to treat different symptoms, with only two species mentioned for the direct treatment of malaria (remocaspi - *Aspidosperma excelsum* and calabash - *Crescentia cujete*), and two for dengue (lemongrass - *Cymbopogon citratus* and *Aspidosperma excelsum*). Collective knowledge about these plant species has accumulated through processes of community validation, mainly through the experiences of traditional medicine practitioners in preparing remedies. In addition, it has been informed by the knowledge and experience of relatives or members of other indigenous Amazonian communities based mainly along the Colombia-Peru border.

Table 5. Plants identified for treating symptoms associated with vector-borne diseases

Symptom/Diseases	Plants used
Fever	Ayahuasca, chanango, chancapiedra, spiral dog's tongue, clavo huasca, escalera de motelo, West Indian lemongrass, lime, cashew, golden apple, mentol, guinea hen weed, orange, African marigold, bellyache bush, remo caspi, sachá ajo, long jack, calabash, yarumo
Headache	Ayahuasca, spiral dog's-tongue, clavo huasca, West Indian lemongrass, lime, malva, cashew, mentol, guinea hen weed, orange, African marigold, jengibre-de-jardin, sachá ajo, cow tree, long jack, calabash
Diarrhea	Annatto, ginger, chuchuhuasa, malva, cashew, bellyache bush, sachá ajo, cow tree, long jack, calabash, hog plum, cat's claw, tropical chickweed, yarumo

Continue Table 5

Symptom/Diseases	Plants used
Body aches	Annatto, ginger, chuchuhuasa, clavo huasca, lime, Caribbean copper plant, malva, guinea hen weed, murure, orange, African marigold, dumb cane, cat's claw
Skin wounds	Goat's milk tree, spiral dog's-tongue, escalera de motelo, cathedral bells, dumb cane, afine tanaecium, yarumo, cat's claw
Intestinal colic	Asai palm, turmeric, chuchuhuasa, cilantro, guinea hen weed, hog plum, tropical chickweed
Bloody stools	Ginger, asai palm, lime, hog plum, cat's claw, yarumo
Anemia	Asai palm, spiral dog's-tongue, escalera de motelo, cashew, cow tree, hog plum
Skin ulcers	Chuchuhuasa, cashew, golden apple, tropical chickweed, sachá ajo
Kidney conditions	Spiral ginger, chancapiedra, clavo huasca
Stomach aches	Ayahuasca, Long jack, afine tanaecium
Gastritis	Chancapiedra, chuchuhuasa, tropical chickweed
Bleeding	Tears of the virgin, hog plum, cat's claw
Use as repellent	Annatto, copal, sachá Ajo
Vomiting	African marigold, West Indian lemongrass, hog plum
Heart conditions	Turmeric, cilantro, guavaberry
Liver conditions	Chancapiedra, cilantro
Seizures	Guinea hen weed, sachá ajo
Muscular weakness	West Indian lemongrass, jengibre-de-jardin
Chills	Annatto, clavo huasca
Malaria	Remo caspi, calabash
Nauseas	Ginger, orange
Insect bites	Golden apple, dumb cane
Respiratory problems	Spiral ginger, apamate
Dengue	Remo caspi, West Indian lemongrass
Rash	Calabash, hog plum
Tumors	Goat's milk tree, long jack
Use in wound healing	Escalera de motelo
Infections	Cat's claw
Used for cleansing of blood vessels	Clavo huasca
High blood pressure	Spiral dog's-tongue

Other studies carried out with indigenous communities in the Colombian Amazon have confirmed the use of various plant species to treat symptoms prevalent within the community. For example, Garzón (2016) identified yarumo (*Cecropia* sp.) as a treatment for diarrhea. Other plants used were cat's claw (*Uncaria guianensis*), used to treat bloody stool, bleeding, and body pain (Lagos 2015, Garzón 2019); and cashew (*Anacardium occidentale*), used for skin ulcers (Vega 2001).

Additionally, Trujillo and González (2011) and Pérez (2007) reported the use of turmeric (*Curcuma longa*) for skin wounds; chancapiedra (*Phyllanthus niruri*) for kidney and liver diseases; cathedral bells (*Kalanchoe pinnata*) for intestinal cramps and skin wounds; bellyache

bush (*Jatropha gossypifolia*) for bloody stool, fever, and body pain; and guinea hen weed (*Petiveria alliacea*) for seizures.

CHARACTERIZATION OF TRADITIONAL MEDICINE PRACTITIONERS' CARE PRACTICES

In common with the other residents of the community, it was found that the traditional medicine practitioners have limited understanding of the types of vector-borne diseases and their associated symptoms. None of the interviewees were familiar with the term “vector-borne diseases,” although they had heard of dengue and malaria. Similarly to other members of the community, the traditional medicine practitioners identified mosquitoes as the principal vectors of disease transmission, and some were able to recognize the specific mosquitoes that transmit malaria:

“The anopheles are those mosquitoes [that bite], especially the female, because there are male and female. When they bite us, they bite in a sort of upright [inclined] position. We, the indigenous people, also know of other types of mosquitoes. There are some mosquitoes around here. If you go right into the jungle, there are yellow mosquitoes and others that are a blueish color, like little dots... I think those can also transmit that disease. That mosquito, when it bites you, at least us Tikuna, well, it can leave little worms in you.” (Elvia Careca, elder of Puerto Esperanza).

Despite their unfamiliarity with the symptoms and vectors, the traditional medicine practitioners have experience in treating a wide range of ailments that affect various demographic groups, such as pregnant women, children, adults, and the elderly. This specialization allows them to develop care practices closely suited to the needs of patients from the community with symptoms of vector-borne diseases. It was observed that, of the medicinal plants identified in the community, a selection of these is prioritized by traditional medicine practitioners for the preparation of remedies, based on their use, method of administration, dosage, dietary restrictions, and contraindications (Table 6).

Factors such as accessibility of plant resources, a high level of experimentation, and treatment efficiency have been essential in promoting the systematic use of these species to treat symptoms related to vector-borne diseases. Based on the Relative Frequency of Citation (RFC) index and the Use Value of Species (UVs), calabash (*Crescentia cujete*) was the species most frequently mentioned by the traditional medicine practitioners (0.17) and had the highest use value (0.63), followed by lime (*Citrus latifolia*), West Indian lemongrass (*Cymbopogon citratus*), and guinea hen weed (*Petiveria alliacea*), each with an RFC index of 0.10 and a UVs index of 0.38.

Table 6. Plants prioritized by traditional medicine practitioners for the treatment of VBDs

Common name	VUs	FRC	Preparation	Administration	Dosage
Totumo (Calabash)	0.63	0.17	Ingested raw	Oral	For malaria and dengue, the green fruit is cut open and the inside is removed. It is mixed with a little water. The person is given one tablespoonful
			Maceration	Topical	For dengue it is applied directly to the skin rash
Múcura (Guinea hen weed)	0.38	0.10	Maceration	Bath	For fever, it is mixed with African marigold leaf, mallow leaf, and lemon shoot. It is crushed with water and the patient is bathed with this liquid. This is done in the morning and at night for two days
			Infusion	Oral	For fever, it is mixed with African marigold leaf, mallow leaf, and lemon shoot. The patient is given two drops to drink. This is done in the morning and at night for two days
Limón (Lime)	0.38	0.10	Decoction	Oral	For hemorrhages, the shoot is combined with the peel of three lemons, yarumo, ginger, and salt. It is prepared as a tea and taken daily until symptoms improve. To reduce fever, the root water is drunk throughout the day
Hierba Luisa (West Indian lemongrass)	0.38	0.10	Infusion	Oral	For dengue, it is cooked with calabash fruit and two whole lemons. The person should be kept covered with a blanket
Sacha Ajo	0.25	0.07	Decoction	Oral	For headache, it is mixed with guinea hen weed and chulo leaf. It is taken as a tea until the person feels better
			Decoction	Bath	For headache, it is mixed with guinea hen weed and chulo leaf. The person's head is bathed with the liquid
			Poultice	Topical	For sores, it is crushed and placed in a clean cloth. The cloth is then placed over the wound
Asai	0.25	0.07	Decoction	Oral	For bloody stool, the root is cut, crushed, mixed with water, and the liquid is drunk until improvement is felt
Mentol	0.25	0.07	Infusion	Oral	For fever, it is prepared as a tea. One liter of water is added and the mixture is boiled. The tea is taken until improvement is felt
Remocaspi	0.25	0.07	Unprocessed	Oral	For malaria, the bark is soaked in water without boiling and is drunk throughout the day
Achiote (Annatto)	0.25	0.07	Decoction	Vaporization	For body pain, it is cooked and the person is exposed to the resulting steam in the hammock at night until improvement is felt
			Decoction	Oral	When the person is sweating, they are given this remedy at night until they feel an improvement
			Maceration	Topical	The fruit is put on the skin as a repellent
Malva	0.25	0.07	Decoction	Topical	To stop bleeding, mallow leaves are boiled and the liquid is applied to the bleeding area
Patequina (Dumb cane)	0.25	0.07	Maceration	Topical	For insect bites, the leaf is crushed and the liquid is applied to the wound using a cotton ball
Naranja (Orange)	0.13	0.03	Decoction	Bath	For fever, water is mixed with orange leaf and lemon juice, and the body is bathed with it until the temperature goes down
			Infusion	Oral	To treat fever, it is mixed with lemongrass leaf and unrefined cane sugar. It is also mixed with lemon fruit. It is taken hot, and the person should be kept covered with a blanket
Cilantrillo (Spiral dog's-tongue)	0.13	0.03	Infusion	Oral	For headaches it is prepared as a tea and taken until improvement is felt
Yaraqui (Tropical chickweed)			Infusion	Oral	For intestinal colic it is prepared as a tea and taken until improvement is felt

Continue Table 6

Common name	VUs	FRC	Preparation	Administration	Dosage
Chuchuhuasa	0.13	0.03	Unprocessed	Oral	For body pain, it is mixed with murure, clavo huasca, huacapurana, and cachaza. One cup is taken in the morning before bathing
Ubo (Hog plum)	0.13	0.03	Decoction	Oral	For hemorrhages, hog plum tree bark is mixed with cat's claw bark and boiled. Three doses are given per day
			Ingested raw	Oral	For anemia the fruit is eaten daily
			Decoction	Oral	For vomiting the bark and leaves are cooked together
Clavo huasca	0.13	0.03	Unprocessed	Oral	To cleanse the blood vessels, the bark and root are mixed with cachaza. One cup is taken daily
Yarumo	0.13	0.03	Decoction	Oral	For fever the root water is boiled and taken throughout the day
Chancapiedra	0.13	0.03	Infusion	Oral	For liver and kidney conditions it is prepared as a tea and taken before each meal
Tangarana rojo (Long jack)	0.13	0.03	Decoction	Oral	For stomach pain and diarrhea, the bark is boiled until the water turns yellow. It is taken once a day
Ajengibre (Ginger)	0.13	0.03	Infusion	Oral	For nausea it is prepared as a tea and taken until improvement is felt
Ruiseñor (Tears of the virgin)	0.13	0.03	Decoction	Oral	For hemorrhages, it is cooked in water until it turns slightly purple. It is drunk throughout the day until healing occurs
Zurba (Cow tree)	0.13	0.03	Ingested raw	Oral	For anemia it is taken pure or with a little water every day
Murure	0.13	0.03	Lotion	Topical	As a repellent, it is mixed with clavo huasca, chuchuhuasa, agua florida, and alcohol
Ayahuasca	0.13	0.03	Decoction	Oral	For head and stomach ache the bark is cooked and taken once
Uña de gato roja (Cat's claw)	0.13	0.03	Decoction	Oral	For hemorrhages, hog plum tree bark is mixed and boiled. It is taken three times a day
Toe	0.13	0.03	Maceration	Topical	For skin wounds the leaves are crushed and applied to the wound
Lupunillo (Caribbean copper plant)	0.13	0.03	Infusion	Oral	For body aches it is prepared as a tea and taken until improvement is felt
Hoja de Tunchi (African marigold)	0.13	0.03	Infusion	Oral	For fever the flower and the leaves are cooked and taken until improvement is felt
			Maceration	Oral	For vomiting several leaves are crushed and taken with a spoonful of water
Uña de gavián (Legume)	0.13	0.03	Decoction	Oral	For diarrhea, the bark is boiled and given to the person to drink throughout the day

The methods used by traditional medicine practitioners to prepare and administer remedies for vector-borne diseases vary. Decoction is the most commonly used method, accounting for 40% of reported uses (Figure 8), followed by infusion and maceration, with 25% and 15% respectively. Meanwhile, for administration of the remedies, the predominant methods were oral ingestion (70%) and topical application (20%).

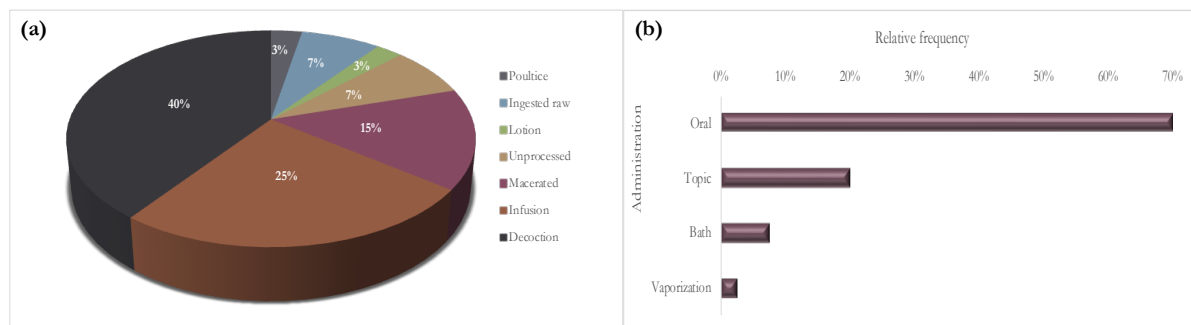


Figure 8. Characteristics of VBD medicines (a) preparation methods, (b) administration methods

In Figure 9, it can be seen that leaves (42%), barks (21%), and fruits (16%) are the most commonly used parts of plants for treating symptoms. Some ethnobotanical studies in the Amazon region have also shown that the leaf is the most frequently used plant part in remedy preparation (Costa et al. 2015, Davis et al. 2021). Meanwhile, other studies have found that decoction and infusion are the main preparation methods used in various Colombian, Peruvian, and Brazilian communities (Lagos 2015, Ferreira et al. 2019, Horackova et al. 2023).

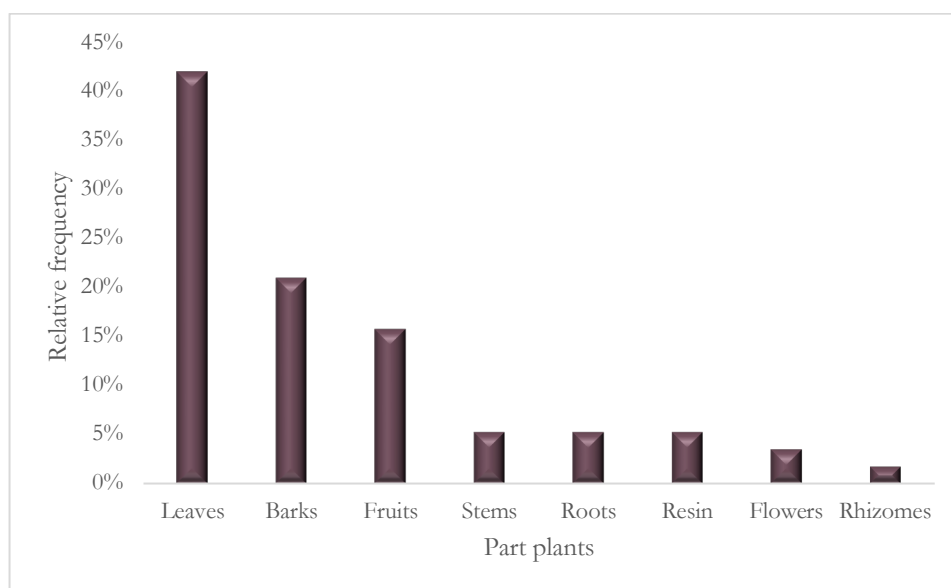


Figure 9. Plant parts used in medicinal preparation

Plant decoction plays a predominant role in healthcare practices in the community. This often involves boiling leaves or bark in water for purposes such as oral ingestion, topical application, or vaporization. For example, a practitioner mentioned that to treat fever, golden apple (*Spondias dulcis*) leaves are boiled in water and given to the patient to drink three times a day. The same water can also be applied topically to clean sores. Similarly, the bulbs of tears of the virgin (*Eleutherine bulbosa*) are boiled until the water takes on a purple color to stop bleeding. This remedy is consumed throughout the day until the patient has recovered.

The traditional medicine practitioners trust in the effectiveness of medicinal plants to treat common symptoms such as fever, diarrhea, and infections. They believe that many of these plants have no adverse effects and that, with the correct dosage, they are a free therapeutic option that is available in their territory. However, they are aware of the possible contraindications or dietary restrictions associated with the use of some of these species:

“The remedy for malaria is...you find calabash here, the seed of the calabash, and you cut it in half, like a watermelon. With a spoon, you scrape out the inside [to extract the seeds] into a cup and add a little water. Then you crush it and strain it. You get the person with malaria to drink it until they vomit, so that the illness in their stomach comes out. Yes. After that, you get them to bathe and they are wrapped up to warm the body until they sweat, and so that way the illness is expelled completely and they get better. For dengue, it’s the same thing. With the calabash...you must follow a diet so as not to eat things that conflict with it. If you don’t follow the diet, you might get poisoned. You should diet for one or two days—avoid fish with skin and catfish, and acidic fruits. On those days you can’t consume anything acidic... You can’t give calabash to a pregnant woman or a very young child, but from 10 years old and up, yes, they can take it.” (Clarindo Coello, traditional medicine practitioner of Puerto Esperanza).

The antiplasmodial and antimalarial properties of calabash have been confirmed through phytopharmacological research (Ibukunoluwa 2017, Ceravolo et al. 2024), as have its antipyretic, anti-inflammatory, astringent, emollient, antiseptic, antibacterial, and antioxidant properties (Ortiz et al. 2016, Teodhora et al. 2021). Additionally, Coutinho et al. 2013 and Aguiar et al. 2015 reported that plants of the *Aspidosperma* genus (Apocynaceae) show activity against malaria parasites. In Puerto Esperanza, traditional medicine practitioners use the unprocessed bark of *remocaspi* (*Aspidosperma excelsum*) for both dengue and malaria, soaking it in water for a few hours and administering it to patients daily until they feel an improvement.

Although practitioners of traditional medicine do not recognize leishmaniasis and Chagas disease easily, some of them shared their experiences in treating symptoms they believe may be associated with these diseases, and described how, in some cases, they combine the use of medicinal plants with pharmaceutical drugs, as explained by the traditional medicine practitioner Alberto Pereira:

“This was someone who came from a community called Progreso. According to his family, they said they had already taken him to the hospital in Leticia, San Rafael. They said the doctors were going to cut off [his leg] because the disease had reached between the bones... First, he got an itch, and from scratching so much, I think a lump formed. Then it started to dry out [the wound], but when he realized, it came back... it looked like it was already black and burned, it opened up, the skin peeled off, it started eating away... and they brought him here... I told him, ‘That’s the famous sore,’ and it was green already. Listen closely... I went to look for chickweed, copper plant leaf, tobacco, creolin, and guama. I told him to buy raw cane sugar and ampicillin. I also had to pray. I started to ask, to beg, a very strong prayer, because I was going to heal him. It began to boil [the remedy],

and as soon as I lifted the leaf covering, it started to steam, and I applied it here [to the wound]. It started oozing like slime, and in the middle of that, the virus came out... I told him, 'Brother, you need to call your daughter to send you some food, because you can't eat anything that goes against the treatment. Only grilled bocachico [a river fish] and mashed plantain...you have to drink coconut water and plantain porridge, nothing else.' I gave him three steam treatments, and it started to dry up. With the same chickweed leaf, I pressed it well— it has its own liquid, its own steam—and it turned green. Then I grated the panela and gave him two tablets of ampicillin. Three days went by, and the flesh started to separate and go red. Then we did another vapor session, and nothing came out, nothing. It turned black and no more blood oozed. It was completely dry."

Some other plant species identified by the traditional medicine practitioners have been associated with potential antimicrobial effects on vector-borne diseases. For example, lemon, turmeric, bellyache bush, hog plum, chancapiedra, and sachá ajo have been recognized for their antimalarial properties (Vigneron et al. 2005, Akono et al. 2014, Imam et al. 2016, Orumwensodia & Uadia 2023). Additionally, lemongrass and cat's claw have been cited for their properties against dengue (Abud et al. 2023, da Silva et al. 2017).

According to the ethnomedicinal research by Ninoska et al. (2022), the aqueous extract of cathedral bells leaf showed antimalarial and antileishmanial properties, as well as insecticidal activity against the *Aedes aegypti* mosquito. Spiral dog's tongue was found to have antileishmanial and antimicrobial activity against the *Trypanosoma cruzi* parasite. Likewise, Matutino et al. (2019) reported the potential of compounds from cashew for the development of inhibitory agents of *Trypanosoma cruzi*.

Several species prioritized by the community have been identified as having pharmacological properties against certain vector-borne diseases. However, not all of these properties are well known by the traditional medicine practitioners or others in the local community. There is therefore an opportunity to incorporate medicinal plants and local practices into public healthcare strategies through a participatory and intercultural approach. Indigenous knowledge systems, which are based on plant taxonomy, preparation methods, and dosage, offer a foundation for the safe and effective use of these plant species.

INCORPORATION OF THE BIOMEDICAL SYSTEM IN THE CARE PATHWAY

Although indigenous communities have developed deep knowledge about the use of medicinal plants and traditional care practices, they also engage with the Western medicine or biomedical system, especially when it comes to health issues that are considered more complex or require advanced care. The decision to turn to traditional or Western medicine largely depends on the type of illness, the availability of resources, and the community members' perception of the effectiveness of the different approaches. In this way, these communities use a dual care strategy that combines both medical systems, adapting them to their specific needs and circumstances.

Most of the people surveyed stated that in the case of a suspected VBD, they prefer to go in the first instance to the hospital or to the health promoter (Figure 10). This is due to a general consensus that at the hospital the disease can be diagnosed and that the treatment administered there for diseases such as malaria may be more effective, considering the rapidity with which the prescribed medication takes effect.

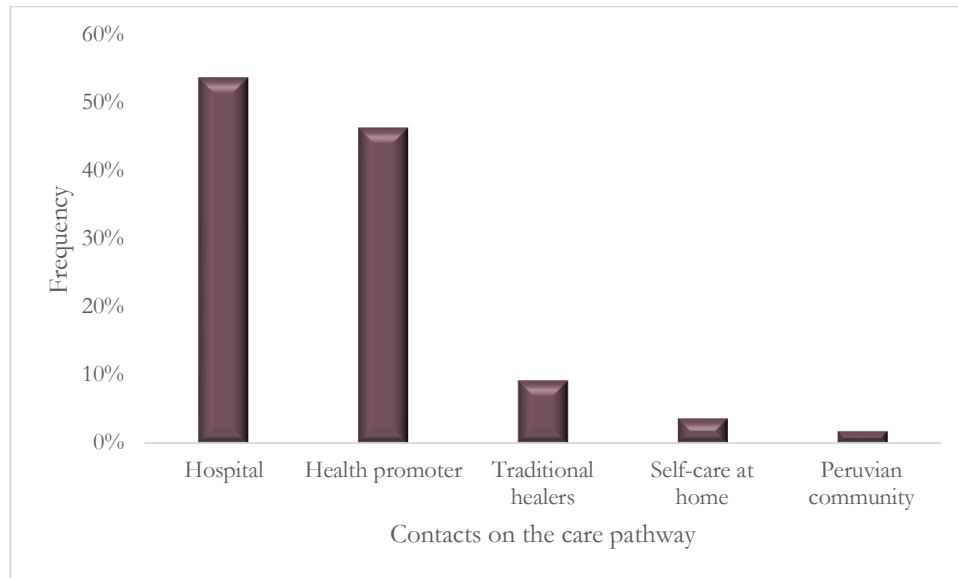


Figure 10. Actors consulted in cases of suspected VBDs

Similarly, people report that their awareness about these diseases, as well as the monitoring and support work of the health promoter in Puerto Esperanza, is fundamental to their decision to go directly to the hospital when the health promoter advises them to do so. As noted by Ríos et al. (2002), the role of health promoters is considered to be flexible and adaptive to the health problems of their communities. For this reason, when the health promoter is considered credible in the community, people trust their judgment when deciding whether to use traditional medicine or go to the hospital in the first instance. The account given by health promoter Rogelio Coello, shows his expertise in supporting the care pathway for vector-borne disease from diagnosis to treatment:

“That was about five years ago, here in the community of Patrullero, an old fisherman... He didn’t want to tell me anything, but his wife did. She said to me: ‘Come, I need you. I don’t know what my husband has on his foot. Something, a wound like this, round, really red,’ she told me. I said, ‘Ma’am, come, I’ll take a look at it.’ The man came... I looked at it like this, and of course, something round—by now I already know, my experience helps, I already recognize things from the kissing bug. It was something really round, like a button. I took him to the hospital. Sure enough, he tested positive for Chagas... he had been bitten by a kissing bug. The doctor gave me the medicine, told me to apply five ampoules for him. And then, 15 or 20 days later, I saw that the bite had dried up [the bite].”

When seeking healthcare services, the community does not restrict itself to Colombian territory; some people go to Peruvian border communities to access medication quickly. For example, some respondents stated that in the case of a suspected VBD, they would go to the health center in the Peruvian community of San Antonio, as it is located just across the river, which means a shorter and more affordable trip compared to what is required to reach the hospital in Leticia.

According to Torres and Soto (2019), the search for healthcare services in border territories has led to the emergence of transnational health practices that transcend geographic, cultural, and political borders. In the case of the Department of Amazonas, the use of health services in Peruvian territory is recognized as an important practice for treating common illnesses and preventing the inadequate healthcare services in riverside communities from being further overburdened (Garzón, 2022). It is important to note that in situations where the first stage of the care pathway for vector-borne diseases is the biomedical system, this is generally because symptoms are clear and easily identifiable. However, the difficulty in identifying these diseases leads people, in practice, to begin with self-care before turning to another level of care.

Based on the biomedical system personnel's point of view, self-care is even more common in contexts where people have limited access to the healthcare system or are reluctant to seek medical attention outside their territory, whether due to economic barriers, cultural clashes, or delays in diagnosis and treatment times. However, they consider that in cases of dengue or malaria, people are relatively quick to make the decision to go to the hospital when the fever is persistent or they have previously experienced some symptoms of these diseases. The care pathway in this system will depend on the severity of the patient's condition and whether they belong to a vulnerable population group:

“They generally don’t wait around at home with this type of illness... I mean, they recognize that it’s a fever, a general discomfort, that it could be malaria or dengue, especially because we’re in an endemic area. So, in that sense, they get to the heart of it quickly. They might wait three days, four days, five days at most. But they almost always come in right away. We are a first-level facility; what we do is manage the current symptoms. Whether they are referred to emergency care depends on the doctor’s evaluation. The age group is also significant, because with an elderly person, we have to act quickly, with a pregnant woman, we have to act quickly, with a child, we have to act quickly... We’ve had patients arrive with very high fevers - 40 degrees [Celsius]—that won’t go down, and they say they’ve already taken medication, bathed, used their medicinal plants, so that’s a patient who must be referred to emergency care, no matter what. Headaches can be managed, joint pain can be managed, but when we start seeing more advanced complications, then they definitely get referred.” (Staff member from the Vector-Borne Disease Program, San Rafael Hospital).

Meanwhile, traditional medicine practitioners are themselves well aware of the importance of recommending that a patient go to the hospital if a set of symptoms persists despite being treated with various medicinal plants. In other cases, they state that people turn to them after being diagnosed at the hospital, so traditional medicine is used as a complementary treatment to what was prescribed by the biomedical doctor, as they believe it does not interfere with the effectiveness of chemical medication and may speed up the body's recovery process.

Although in practice there is no evidence of intercultural coordination between traditional and Western medical systems in care processes, some officials from departmental institutions, such as the Public Health Office of Puerto Nariño, acknowledge that they need to work with the hospital to revalue the work of traditional medicine practitioners. The ideal situation would be for their treatment practices to be considered on an equal footing with those of hospital doctors, and for this to become part of a comprehensive management strategy and intercultural care approach for vector-borne diseases, especially dengue and malaria.

CHAPTER IV. EPIDEMIOLOGY, SURVEILLANCE AND CONTROL OF VECTOR-BORNE DISEASES

Vector-borne diseases are one of the greatest challenges to public health worldwide. For this reason, it is necessary to strengthen the pillars of epidemiology, surveillance, and control of these diseases, providing a mechanism to prevent epidemics and reduce the risk of transmission within the local population. Epidemiology enables the understanding of transmission patterns, the identification of vulnerable populations, and the assessment of risk factors associated with these diseases.

Meanwhile, surveillance at the community and clinical levels provides crucial information for the early detection of VBD outbreaks. The integrated control of these diseases, combining strategies such as environmental management, chemical and biological vector control, personal protection, and community education, is essential for reducing morbidity (the proportion of people who become ill) and mortality (the proportion of those who die).

This chapter addresses issues related to the epidemiological panorama of VBDs in the Department of Amazonas and the surveillance system in place within health institutions. It also explores the role of health promoters in community surveillance, who act as the first link in the reporting and control chain. Finally, it describes some integrated strategies for VBD control through the analysis of housing conditions and the implementation of the eco-health calendar.

EPIDEMIOLOGICAL OVERVIEW OF VBDs

The ecological and sociodemographic conditions in the Department of Amazonas are favorable to the spread of vector-borne diseases. This results in adverse health situations. For example, in 2023 this department reported the highest number of dengue cases in the country, with 1,926.4 cases per 100,000 inhabitants (MinSalud, 2023). Malaria and dengue are the main VBDs affecting the local population and are characterized by seasonal patterns and a generally well-defined geographic distribution.

According to the National Public Health Surveillance System - SIVIGILA (2025), malaria was the most prevalent disease among the local population in 2024, affecting, among others, 214 children under the age of five and 77 adults over the age of 65. It was also observed that cases of mucosal and cutaneous leishmaniasis were reported mainly in the central area of the department, while Chagas cases were diagnosed along the shoreline of the Amazon River, in the border area with Peru (Table 7).

Table 7. VBD events in the Department of Amazonas – 2024

Event	Origin	Sex	No. of cases	Total
Malaria	Tarapacá	Men	506	2239
		Women	383	
	Leticia	Men	373	
		Women	187	
	Puerto Nariño	Men	213	
		Women	128	
	La Pedrera	Men	137	
		Women	121	
	Puerto Santander	Men	55	
		Women	32	
	La Victoria	Men	25	
		Women	16	
	La Chorrera	Men	15	
		Women	15	
	Mirití Paraná	Men	14	
		Women	11	
	Puerto Arica	Men	5	
	Puerto Alegría	Men	1	
		Women	1	
	El Encanto	Women	1	
Dengue	Leticia	Men	461	961
		Women	365	
	Puerto Nariño	Men	41	
		Women	35	
	La Pedrera	Men	10	
		Women	7	
	Tarapacá	Men	11	
		Women	6	
	Puerto Santander	Men	3	
		Women	4	
	La Chorrera	Men	4	
		Women	2	
	Puerto Arica	Men	3	
		Women	2	
	Puerto Alegría	Men	2	
		Women	2	
	El Encanto	Men	1	
		Women	2	
Mucosal Leishmaniasis	Pedrera	Man younger than 65 years	1	2
	Tarapacá	Man younger than 65 years	1	
Cutaneous Leishmaniasis	La Chorrera	Man younger than 65 years	5	17
	La Pedrera	Man younger than 65 years	4	
		Woman younger than 65 years	2	
	Leticia	Woman older than 65 years)	1	
		Man younger than 65 years	3	
	El Encanto	Man younger than 65 years	1	
	Puerto Nariño	Man younger than 65 years	1	
Chagas diseases	Puerto Nariño	Woman younger than 65 years	3	3

Source: Created based on data from SIVIGILA (2025)

The population infected with dengue included 29 children under the age of five and 71 adults over the age of 65. Seven cases of severe dengue were also recorded, mainly involving women and one minor. According to Zambrano (2017), dengue is classified as severe when there are complications such as respiratory difficulty, severe bleeding, major organ failure, episodes of unconsciousness, or heart failure.

When analyzing malaria and dengue reports for 2024, it was observed that 21.53% of malaria cases and 26% of dengue cases were identified among the indigenous population, affecting a total of 482 and 250 people, respectively. This indicates that, although the prevalence of dengue in the territory has decreased, indigenous communities are more vulnerable to the transmission of this disease.

According to officials in the Epidemiology Department of the San Rafael Hospital in Leticia, dengue is prevalent in the urban area of Leticia and has recently reached Puerto Nariño, where cases began to be reported in 2021. They also mentioned that malaria mainly affects communities located along the shore of the Amazon River and in rural areas. They believe malaria impacts all age groups, though more frequently young adults, possibly due to greater exposure to mosquitoes during activities such as fishing and working in the chagra cultivation areas.

Reports from the Public Health Surveillance and Epidemiology Office of the Departmental Health Secretariat showed that in the first half of 2024, the number of dengue cases decreased compared to the previous year (Figure 11). In the last two years, there has been a high number of cases around epidemiological week 14, which corresponded to the first week of April in 2023 and to the second week of April in 2024.

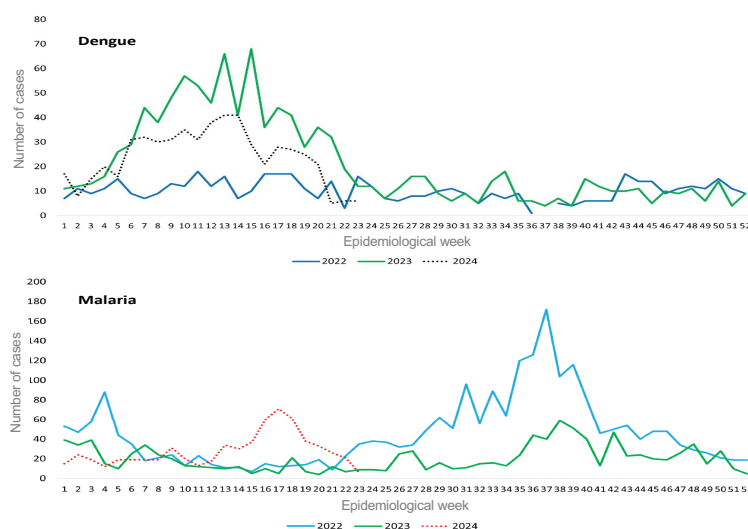


Figure 11. Case reports for the Department of Amazonas from 2022 to 2024
Source: Secretaría de Salud Departamental (2024b)

In the case of malaria, atypical behavior was observed in 2024, reaching a peak in infections between epidemiological weeks 16 and 17, that is, at the end of April and beginning of May. The Secretariat's report also highlighted that during this period, indigenous communities under the jurisdiction of the municipality of Leticia were the most affected, especially Nazareth, which occupied the first position with 47.6% of cases, followed by La Libertad (9.5%) and Arara (6.9%). Of the total reports, 95.6% corresponded to *Plasmodium vivax* infections, 3.9% to *P. falciparum*, and 0.3% to mixed infections. In the case of Puerto Esperanza, one case was confirmed in an elderly woman.

A member of staff at the San Rafael Hospital in Leticia shared her experience regarding dengue and malaria cases, particularly concerning mortality and critical periods of contagion:

“We haven’t had any deaths from malaria, and the few cases that we initially classified as probable dengue and where the patient died, we ultimately ruled out... Dengue always hits us hard at the beginning and end of the year here in Leticia. Malaria had been quite stable until last year. This year, there was a terrible surge, and in fact, we still don’t have an explanation for why we had such an overwhelming number of malaria cases. We identified them as coming from a community called Nazaret and La Libertad, so we don’t know the reason for the surge - those communities always live with the vector, but this time it just flared up. We noticed that this year, the situation was relentless during the first few months of 2024. As for the other districts, Tarapacá has many cases at the start of the year and these drop toward the end of the year. Pedrera behaves in the opposite way - it starts with a few cases and ends up overwhelmed, practically in the last quarter of the year. So, I imagine that has to do with the seasons, since these two districts are located along different river basins. So, while one river is high, the other is low—maybe that’s the reason.”

This epidemiological overview of the Department of Amazonas, particularly in the municipalities of Leticia and Puerto Nariño, highlights the complexity involved in analyzing vector-borne diseases in the region and the challenges they pose in terms of public health. Due to the ecological, demographic, and geographic conditions that favor their transmission, these tropical diseases represent a significant burden in terms of both morbidity and mortality, especially for the most vulnerable populations.

EPIDEMIOLOGICAL SURVEILLANCE SYSTEM

According to the World Health Organization (2022), epidemiological surveillance systems are organized and dynamic structures that systematically compile, analyze, and interpret data on specific health events affecting a given population, with the purpose of guiding public health actions. These systems are of fundamental importance because they enable the early detection of outbreaks and epidemics, facilitate the identification of patterns and trends in disease distribution, and support the planning and evaluation of health interventions.

As described by a staff member from the Epidemiology Department at San Rafael Hospital, surveillance of vector-borne diseases (VBDs) in the Department of Amazonas is carried out through a structured system that integrates different levels of care. This process starts out with the initial care provided by health personnel in hospital centers, where a preliminary analysis is carried out based on the set of symptoms presented by patients.

The classification of cases and reporting of them to SIVIGILA are done based on this initial diagnosis, which is why many cases appear in the system as “suspected.” Health service providers are responsible for the follow-up of potential cases reported by external institutions. In this regard, the IPS (healthcare provider institutions) receive all clinical information about patients who seek emergency care at San Rafael Hospital or the Clínica Leticia Foundation. Regarding this VBD monitoring process, some adverse situations were identified:

“Most of the cases are put down as suspected because we’ve followed up and they don’t have confirmatory tests. Depending on the symptoms, they’re classified as dengue, malaria, chikungunya, Zika, well, in general, although now it’s most commonly malaria and dengue. They come in as suspected cases but without confirmatory tests, and then we receive feedback from SIVIGILA, which is sent to us from the central office. Every week, they send us the events, and that’s where we begin our follow-up. In addition to that, we have our CRONIS system, where we can find addresses and phone numbers. That’s where there is a flaw, because we don’t have up-to-date addresses or phone numbers, we rely on the updates from the last consultation. So that is a barrier to follow-up, because sometimes they report a case as both malaria and dengue, and then I have to work out whether it’s malaria or dengue. When I locate the patient and check the clinical history, I can identify that it was ruled out as dengue but confirmed as malaria, so I know what I have to do. We’re not lucky every day because sometimes the address or the phone number is wrong, so that’s where our follow-up gets interrupted.” (IPS Mallamás member staff, 2024).

As an alternative to the follow-up conducted by the IPS, hospital centers monitor their own records. This is because, in most cases, confirmation of an illness such as dengue or malaria is only available after the patient has already been treated. To monitor cases at the hospital, notification forms are used that collect key information about the individual. These forms have a series of questions aimed at determining the place of origin, whether the person traveled within or outside the department, how the symptoms first appeared, and how those symptoms may be related to a possible exposure site.

The coordinator of the Vector-Borne Disease Program at the hospital gave a summary of the cases and their tracking, based on the information collected from these notification forms and other additional sources. For example, the official mentioned that in 2023, two cases of leishmaniasis and one case of Chagas disease were reported. While she was unaware of the specific type of leishmaniasis, she confirmed that one case was imported, a foreign woman from Guatemala, and the other involved a seven-year-old girl who lived along the highway (on the outskirts of the municipality, on the Leticia-Tarapacá road).

Additionally, she stated that malaria affects the entire nuclear family, with the infection usually starting with the parents and then spreading to the children, thus impacting all age groups. The most severe cases reported up to the date of the interview (July 2024) were of a two-year-old child and two elderly adults between 80 and 85 years old. Regarding the origins of the infections, the official confirmed that most of the cases came from communities located along the shores of the Amazon River. The most affected riverside communities included La Libertad, Nazaret, and Arara, while in areas accessible by highway, cases were reported in communities such as San Pedro de Los Lagos, San Antonio de Los Lagos, and San Juan de Los Parentes.

In view of the severity of the spike in malaria infections in the department, departmental and municipal health institutions met during the first half of 2024 to determine the points of origin and decide on control measures in response to the situation. In the case of the community of Nazareth, which was considered one of the most critical areas, a tracing of the infected population was carried out. Many of the diagnosed individuals reported that they had not traveled recently, which made it highly likely that the main source of contagion was internal and that the transmission of the disease began with isolated cases of people arriving from other communities.

There are other cases of malaria that hospital officials refer to as imported, as they involve people who developed symptoms after returning from Peruvian communities such as Santa Rosa de Yavarí, La Montañita, Puerto Alegría, and Dos de Mayo. This demonstrates that epidemiological surveillance of vector-borne diseases in the department must include an analysis of cross-border migratory movements.

This type of mobility presents an additional challenge for surveillance processes that goes beyond just the transmission of VBDs. As one official mentioned, there are no harmonized therapeutic protocols between neighboring countries, which can lead to situations of “relapses” or clinical complications:

“We have a problem with patients who come from other countries, from Peru or Brazil, right? They know they have malaria, and they get treated over there. I don’t know if it’s that they stop the treatment or if their treatment is different, though I don’t think so. And they come here with the same symptoms, so we begin examining them and the treatment they’ve received doesn’t align with what we use here. So, we have to restart their treatment and explain to them that they have to finish it; if they don’t complete the 14 days, the parasite won’t go away. So, there’s also an educational component for people who just don’t follow the treatment, because some people, once you tell them the first time that they need to take the medication for 14 days, they are responsible for their self-care. But others aren’t, they take 3, 4, 5 doses and once they feel better, they stop.”

The movement of people between the diverse communities of the tri-border area (Colombia, Brazil, and Peru) is a critical factor that can impact the spread of the microorganisms responsible for VBDs. Migratory flows can introduce new infectious agents into previously

unaffected areas and, consequently, alter the geographic distribution of diseases such as dengue or malaria in the Department of Amazonas.

ROLE OF HEALTH PROMOTERS IN COMMUNITY SURVEILLANCE

Community surveillance is a participatory process in which community members actively collaborate in the detection, reporting, and control of public health problems. In the context of vector-borne diseases, this approach is very valuable as it enables the early identification of cases, monitoring of vector breeding sites, and timely implementation of preventive measures. This approach is considered to complement formal epidemiological surveillance systems, as it facilitates faster and more effective responses in areas in locations that are difficult to access, strengthens local knowledge about the disease, and promotes the sustainability of interventions by empowering communities to care for their own health (Martínez et al., 2023).

In Colombia, a strategy called “Community-Based Public Health Surveillance (VSPC in its initials in Spanish)” has been implemented, in line with SIVIGILA guidelines. According to MinSalud (2014), this strategy aims to identify, analyse, and communicate knowledge related to events, risk factors, and aspects that may impact the well-being and quality of life of the local population. This surveillance process is shaped based on information collected, reported, or generated by the people themselves, organized in a collective way.

Health promoters play a fundamental role in this community surveillance process within the department, as they are the bridge between the community and the institutions of the biomedical system, particularly the Departmental Health Secretariat, as this is their employer. Likewise, they can be considered as the main sources of health information within their communities, and therefore also have a key role in coordinating with traditional medicine practitioners to support healthcare processes.

As noted by a staff member of the VBDs program, health promoters undergo a training process with the Health Secretariat to carry out their activities within the communities. During this training process, their input is also sought so that the different territorial realities can be understood and the various activities that have been designed by the institution can be contextualized accordingly:

"We, the VBD Program, are also in charge of providing training. The last one we did was last year, as we haven't started the process in the current cycle yet, but yes, we do provide training. In it, we give them all the information and provide them with materials on each of these diseases. Also, during those sessions, they share their experiences with us, because many of these promoters are originally from those communities and have been working within them. So, in those spaces, we talk and discuss and... we resolve many questions and say, 'well, this is important, but it's also important to do it this way, it's also important to prevent it this way. How is it going in your community?'... then, 'How are we going to work on it?' 'Ah, okay, great.' And that's what we are doing with them. We did that, I

think, between October and November [of 2023]. Those who, for example, work directly with us in the VBD program, like the ones who go to Tarapacá or La Pedrera, receive ongoing training and follow-up from us, and when we are in the community with them, they participate in the processes with us.”

Although the roles of health promoters vary according to the health problems in their communities (Ríos et al., 2002), their work regarding the management of vector-borne diseases is mainly focused on identifying symptoms, carrying out preventive measures, and follow-up, especially in relation to medication adherence, that is, ensuring that people complete the full dosage.

This last issue has been identified as a relatively serious one, especially in the control of diseases like malaria. A staff member from San Rafael Hospital mentioned that in many cases, people do not complete the treatment because they think they can stop taking it once their symptoms begin to disappear and they start to feel better. Even though doctors inform patients that they should return for follow-up appointments 7, 14, and 21 days after starting treatment, people usually do not come back for this ongoing monitoring of their state of health.

Lack of adherence to treatment leads to a potential increase in the risk of drug resistance and cases of "relapses," where individuals are readmitted to the hospital with more severe symptoms than those reported at the time they were diagnosed. In Puerto Esperanza, people mentioned that some did not return for follow-up appointments due to a lack of time or financial resources to travel to the hospital in Leticia, while others said they kept the remaining medication to have it available in case they or someone they knew got sick with malaria again.

In the face of these problems, health promoters are considered to have a dual responsibility: following up with patients to check they take the full dose of their medication, and educating the population to make them aware of the consequences of not attending follow-up appointments and or completing treatment. In this regard, the aides have the support of key actors such as traditional medicine practitioners, who can convey this knowledge in a way that is integrated with their treatment practices, thereby fostering a complementary relationship between the two medical systems.

In addition to the reasons described above, follow-up of VBD cases within the communities is important in order to identify whether there is an increase in the number of infections, to trace the possible origin of the infection, and to reinforce preventive or control measures. In Puerto Esperanza, the health promoter has worked rigorously to identify symptoms related to these diseases and to provide support to potentially infected individuals:

“So, everyone who got sick here, I would send them to the hospital. It was at the hospital that they ran the tests, took some samples and, well, if the result came out positive, the doctor would confirm it with me, tell me to keep a closer eye on the people. There are

dengue cases and so on, but right now it seems to have calmed down... there are malaria seasons, like when people travel a lot to Peru or go somewhere else, and they bring malaria back from there... and it affects the community here... right? Let's take the case, say, when a lot of people were going to work in the coca fields, young men and others would go to work out in the jungle, and then they'd come back here with malaria, because I saw people come back saying, 'I feel like this, I'm hot, and I have this, and my head hurts.' I would look at them and say, you have malaria. And well, if I took them to the hospital, of course, they'd turn out to have malaria. And I'd ask, where have you been? Oh, well, of course, because you're out there, in the jungle and all that."

Despite the significance of health promoters as a link between the health systems and the indigenous population, there is a clear shortage of human resources, which significantly affects the capacity for community-level monitoring and timely response. For example, the Health Coordinator of ATICOYA mentioned that there is insufficient coverage, as they have only six health promoters for the 20 communities in the area they are responsible for.

Given the above, it is considered important for the work of the promoters to be supported by other community actors, who can participate in the planning, dissemination, and follow-up of multiple local strategies, incorporating traditional knowledge and culturally appropriate practices in community surveillance (Table 8).

Table 8. Proposed activities for community surveillance

Activity	Description	Estimated Frequency	Social Actors	Cultural Considerations
Early detection of symptoms	Identification of suspected cases according to community defined signs and symptoms	Daily	Health promoter and traditional medicine practitioners	Integrate local knowledge of VBDs and their symptoms
Community reports	Alert system to report suspected cases to the health services	Immediate (when cases arise)	Community reporting network (adults and young people)	Use traditional and modern communication channels
Patient follow-up	Home visits to confirmed or suspected cases	Immediate (when cases arise)	Health promoter	Respect cultural practices during the illness
Recording of community cases	Recording of confirmed and suspected cases	Monthly	Health promoter, community leaders	Culturally-adapted recording system
Participatory analysis of information	Meetings to analyze epidemiological data and take decision	Monthly	Traditional authorities, health promoter, traditional medicine practitioners	Incorporate cultural interpretations of disease pattern

In communities such as Puerto Esperanza, it is worthwhile considering the possibility of establishing a community reporting network. This would be a group of individuals who can lead an early warning system with clearly established reporting channels and mixed communication tools that combine traditional methods with modern technology. This network could be made up of actors such as the health promoter, traditional authorities,

community leaders and traditional medicine practitioners, with the support of adults and young people in monitoring potential vectors and VBD cases within their community.

To counter potential challenges related to the formation and sustainability of such a network, such as staff turnover and limited financial resources, external support from health institutions or other types of organizations can be considered, along with an incentive system defined by the community itself. It has been shown that communities with effective networks have demonstrated greater capacity for early outbreak detection, timely response generation, community participation in preventive actions, strengthened health governance, and improved intercultural coordination with biomedical system institutions (Rubán et al., 2019).

HOUSING CONDITIONS AND VBD CONTROL

Housing conditions can pose a challenge for vector control in indigenous communities, as homes and their surroundings may have certain features that facilitate the proliferation of insects. Through door-to-door visits and surveys carried out in Puerto Esperanza, it was observed that most homes share similar characteristics, such as aluminum roofs and wooden floors or walls. The material used in the walls can develop cracks over time, creating additional spaces where insects can rest and reproduce, complicating fumigation or chemical control efforts.

A notable risk factor is the presence of open spaces such as living rooms and dining areas with windows covered by a mesh screen, which allows mosquitoes to enter freely, especially during their peak activity hours. Although this spatial configuration is rooted in cultural patterns and climate adaptations, it facilitates contact between the residents of homes and vectors of diseases such as malaria, dengue, and Chagas disease.

Mosquito nets have been adopted in the community as the main protective measure during the night. This preventive behavior reflects a widespread trend, as mosquito nets, especially when treated with insecticides, have been among the most commonly-used mechanisms to break the transmission chain of vector-borne diseases, particularly malaria (Vilema, 2015). Most of the surveyed individuals said that they replace their bed nets approximately every six months, suggesting an awareness of the need to keep this physical barrier in good condition.

Rainwater storage is another critical factor in the proliferation of vectors in this community. Due to the lack of access to potable water and limited sanitation conditions, households rely on the use of various types of water containers. It was found that tanks are the most commonly used storage units, followed by buckets (Figure 12). Only 13.2% of the homes visited use a washbowl as their water storage source.

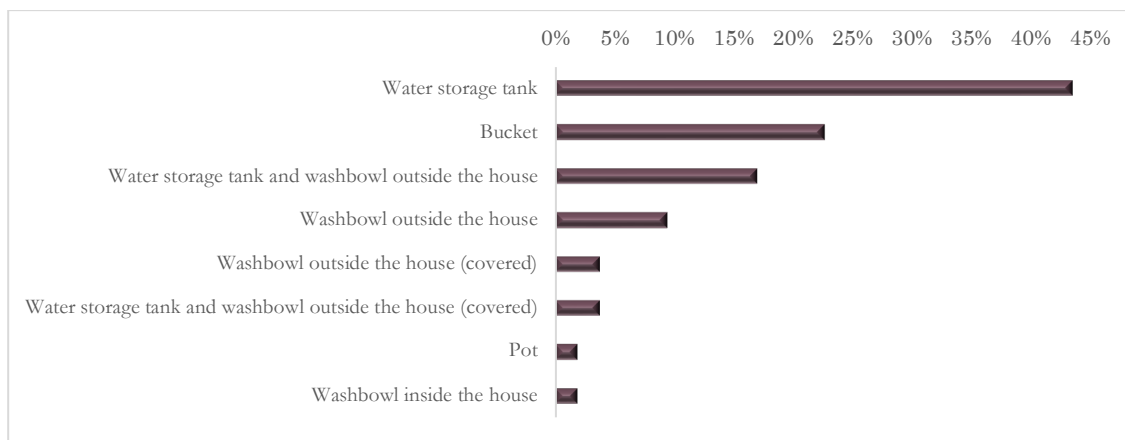


Figure 12. Water storage frequency in homes in Puerto Esperanza

In 21% of the homes visited, both tanks and washbowls were found, and of these, 4% consisted of containers inside the home. It was also observed that people who use pots, buckets, or other water containers typically use 2 to 3 containers simultaneously. This contributes to the risk factors for vector control, as it multiplies the number of potential mosquito breeding sites in and around homes.

To address these challenges, interventions should focus on adapting existing structures by installing mosquito screens in open spaces and sealing gaps between walls and roofs. It is essential to optimize protection practices that have been adopted so far by promoting the cleaning of areas around homes and the use of bed nets, especially those treated with long-lasting insecticides.

Water storage management requires attention as a priority. Potential mosquito breeding sites could be significantly reduced by the use of secure lids for all containers, especially daily-use items like buckets and pots, establishing community routines for regular cleaning, applying larvicides to large containers, and promoting the use of fewer but larger-capacity containers. These measures should be complemented with community strategies and educational campaigns that show the connection between water storage practices and the risk of VBDs (Table 9).

Table 9. Proposed activities for vector control

Activity	Description	Frequency	Cultural Considerations
Monitoring breeding sites	Identification and mapping of vector reproduction sites (water containers, plants)	Weekly	Respect areas of cultural significance
Participatory diagnosis of homes	Evaluation of walls, roofs, floors and the areas around homes	Quarterly	Respect traditional designs and local materials
Mapping vulnerable homes	Identification and prioritization of homes at greater risk due to structural factors	Half-yearly	Consider traditional structural layouts

Continue Table 9

Activity	Description	Frequency	Cultural Considerations
Monitoring of habit improvements	Follow up of activities such as screen instalment, improvement of roofs and elevation of floors	Quarterly	Incorporate solutions that respect traditional architecture
Natural repellent production	Production of repellents based on annatto, copal and sacha ajo	According to the season	Record and value ethnobotanical knowledge
Community cleaning campaigns	Community cleaning days to remove breeding sites and improve the space	Monthly or according to the season	Coordinate with indigenous concepts of harmony with the natural environment

In this context, some communities have developed their own strategies for vector surveillance and control. One example is the implementation of community cleaning days in San Juan del Socó, as noted by a Public Health Office official from Puerto Nariño who lives in this community:

"Here in our community, we have the custom that every Saturday there is a community clean-up, so everyone in the community gathers, they already know, they're in the habit of meeting up, so the women rake, collect papers and bottles, and the men do the weeding where the grass is tall."

When planning these community interventions for VBD control, the specific vectors predominant in the region, such as *Anopheles* for malaria and *Aedes* for dengue, need to be considered, and the control schedules adjusted to their reproductive cycles. An integrated approach that combines structural improvements, optimization of existing practices, appropriate water management, and community strategies adapted to the local context can significantly contribute to reducing the transmission of vector-borne diseases in indigenous communities.

ECO-HEALTH CALENDAR

The eco-health calendar is a valuable integration of traditional knowledge and ecological understanding that maps the seasonal patterns of diseases in relation to environmental, social, and economic factors (SantoDomingo et al., 2016). Its main purpose is to provide a guide that enables populations to plan and adapt their daily activities, such as planting, harvesting, gathering medicinal plants, and health care, according to ecological conditions.

Moreover, this calendar reflects an indigenous conceptualization of time and health that differs significantly from linear biomedical models. In this worldview, health is conceived as the result of harmonious relationships between human beings, the natural environment, and the spiritual world. Diseases are seen as imbalances in these relationships, which follow predictable patterns connected to natural cycles.

In Amazonian communities, the eco-health calendar is of vital importance, as these people maintain a close relationship with their natural environment and traditional practices. Historically, this has manifested in sophisticated systems of observation and understanding of natural cycles that affect their health and well-being. Thus, their knowledge of ecological cycles enables them to prevent diseases, improve nutrition, and ensure better adaptation to environmental changes. This knowledge reinforces their cultural and ecological resilience in the face of external threats.

The ecological health calendar approach is aligned with the principles of eco-health, whereby the complex interaction between environmental conditions, human activities, and the proliferation of diseases is recognized (Betancourt et al., 2016). This tool is of great use in the management of vector-borne diseases, including malaria, dengue, leishmaniasis, and Chagas disease, due to these diseases are strongly influenced by ecological dynamics that often follow annual cyclical patterns and so tend to exhibit repetitive behavior throughout the year.

The construction of this type of calendar through participatory methodologies not only documents valuable local knowledge but also empowers communities to actively participate in the management of their own health. By recognizing and valuing traditional knowledge, the calendar serves as a bridge between indigenous knowledge systems and Western scientific methodologies, promoting an intercultural dialogue that enriches vector-borne disease prevention and control strategies.

Considering the above, the development of the eco-health calendar in Puerto Esperanza was framed as a community surveillance tool focused on understanding eco-bio-social dynamics from a perspective that incorporates community knowledge (Figure 13). For the joint creation of this calendar, information previously gleaned from interviews and surveys was taken into account, which was complemented by a participatory workshop held in the maloca (a traditional community dwelling).

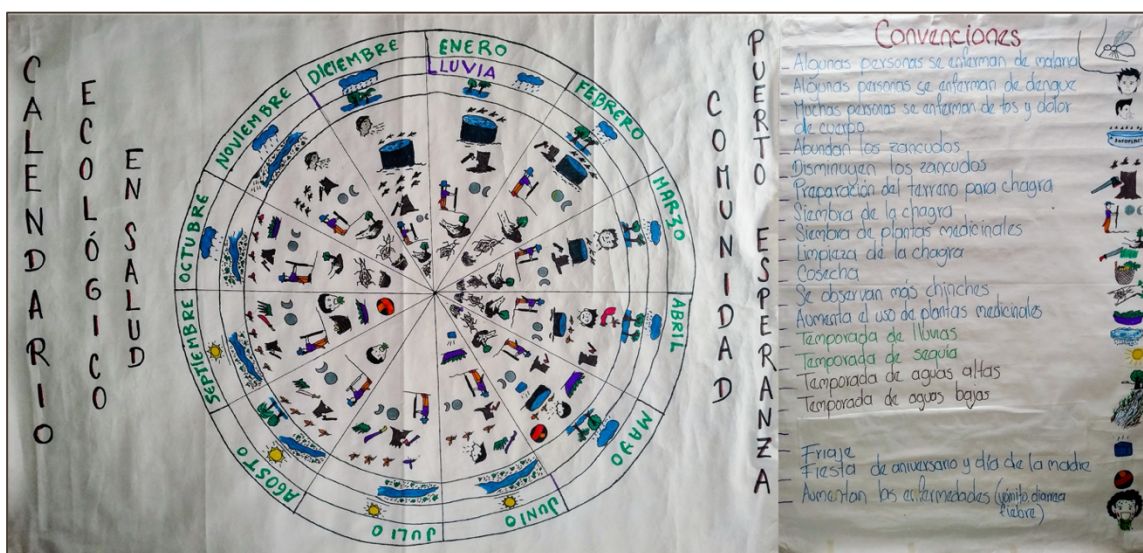


Figure 13. Eco-health calendar for VDBs in Puerto Esperanza – 2024

Through a process of dialogue with participants, the various ecological, biological, and social elements that make up this calendar were identified. Ecological factors included changes in the water level of the Amazon River, periods of rain and drought, as well as times of increase and decrease in vector populations. Subsistence activities were also taken into account, such as the main periods of preparation and clearing of chagras (cultivation areas), planting, and harvesting. Significant cultural activities were also included in the calendar, such as the community's main festivities. Finally, epidemiological aspects were considered, such as the periods with the greatest incidence of dengue and malaria cases, and increases in symptoms such as cough, fever, body aches, vomiting, and diarrhea.

- **Seasonal patterns, water dynamics and vector proliferation**

The calendar shows two clear seasonal patterns over the course of the year: the rainy season (Spanish legend: Temporada de lluvias) and the dry season (Spanish legend: Temporada de sequía). The community considers the rainy season to occur between January and May, and again from November to December. The month of October is considered a transition period from the dry to the rainy season. Meanwhile, the dry or low-rainfall season was identified as occurring between June and September.

There is a weather phenomenon known in the Amazon region as “el friaje,” a period of three to seven days when there is a sudden and sharp drop in temperature, accompanied by strong winds. This phenomenon is caused by a mass of cold air coming from Antarctica that enters from the south of the continent and usually coincides with the southern hemisphere’s winter, between July and August (Jiménez et al., 2023). Although this meteorological event may occur several times a year, the community considers “el friaje” to take place in June, when they perceive the biggest drop in temperature.

The calendar records the water levels of the Amazon River, which can be divided into the “low water season” (Spanish legend: Temporada de aguas bajas) and the “high water season” (Spanish legend: Temporada de aguas altas). The lowest river levels were identified between June and July, and from September to November. In contrast, in the months from December to May, the water level tends to rise. August is considered a transition month in which some temporary increases in water levels are observed before the level drops again.

These patterns of rainfall and fluctuations in the water level of the Amazon River can directly influence the breeding habitats of vector populations, particularly those of mosquitoes that transmit malaria and dengue. As indicated in the calendar, there are specific periods when “mosquitoes abound,” (Spanish legend: Abundan los zancudos) between the months of December and May, typically after rainy periods when stagnant water creates breeding sites.

The community considered there to be a greater presence of mosquitoes in December, when the transition from low to high water begins and rainfall increases. On the other hand, they found that the number of mosquitoes decreases during the dry months (Spanish legend: Disminuyen los zancudos), especially from May to September. Regarding the “pito” commonly known in English as the kissing bug, they mentioned observing greater numbers

of these during the rainy season, particularly from October to May (Spanish legend: Se observan más chinches).

The months of March and April were identified as having the highest number of dengue cases (Spanish legend: Algunas personas se enferman de dengue). This period coincides with the rainy period during the low-water season. The month of April was also cited as a time with increased malaria cases (Spanish legend: Algunas personas se enferman de malaria). It is worth noting that participants identified these months based on the infections among people they know, both within and outside the community, for the year 2024.

- **Agricultural activities and risk of exposure to vectors**

The agricultural cycles incorporated in the ecological calendar of Puerto Esperanza include "preparation of the land for chagra" (Spanish legend: Preparación del terreno para la chagra), "planting of the chagra" (Spanish legend: Siembra de la chagra), and "harvest" (Spanish legend: Cosecha). These practices are carried out during both the rainy and dry seasons. However, certain activities must be done at specific times, for example, the clearing of chagras is usually carried out during the dry season, while harvesting tends to be done during the rainy months, especially from February to May and October to November.

Similarly, the planting of crops follows the timings particular to each species, depending on their ecological requirements. Cassava and plantain are not cultivated during the rainy season, so they are not planted until September. Other plants, like asai and copoazú, are typically planted between February and March, while pineapple is cultivated between September and November. It is important to highlight that people take into account the influence of the moon phases on plant growth; specifically, planting is avoided on full moon days, new or waning moon phases are preferred.

These activities can influence human-environment interactions and exposure to vectors, as during periods of agricultural intensification, community members spend more time in cultivation areas and near vector habitats. This increases the risk of exposure, especially in the months of April and May, when mosquito populations rise and peaks in dengue and malaria cases may occur.

- **Traditional knowledge and health practices**

As described in Chapter III, "Characterization of care pathways and practices in the community," the use of medicinal plants plays a fundamental role in self-care activities and in the care provided by traditional medicine practitioners. The calendar includes references to the planting of medicinal plants and increases in their use within the community (Spanish legend: Siembra de plantas medicinales). Specifically, the planting period of medicinal plants was recorded as being in the rainy season between October and May, since participants consider this to be the time when most planting takes place.

Additionally, in the months identified as transitional from rainy to dry season (May - June) and from dry to rainy season (September - October), an increase in the use of plants for the preparation of remedies was identified. Community members mentioned that during these months, a higher number of people tend to fall ill, with a wide range of symptoms ranging from respiratory to gastrointestinal issues.

The symptoms most associated with the transition from the rainy dry season were cough and body aches (Spanish legend: Muchas personas se enferman de tos y dolor de cuerpo), and these continued during the rainy months of November and December. Other symptoms, such as fever, vomiting, and diarrhea, increase in dry months such as August and September (Spanish legend: Aumentan las enfermedades – vómito, diarrea y fiebre). While it cannot be confirmed that these symptoms are directly linked to vector-borne diseases, they serve as local diagnostic indicators that could be used for early detection and treatment.

- **Social gatherings and disease transmission**

The calendar incorporates community events such as the “anniversary celebration” and Mother’s Day, gatherings that could potentially increase the transmission of diseases due to greater human contact (Spanish legend: Fiesta de aniversario y día de la madre). During these festivities, a series of social activities are generally held involving residents of other communities in the tri-border area. For example, it is common for soccer tournaments to be held at these events, where teams from other communities are invited and may enter and leave over the course of the competition, which lasts approximately 15 days.

Mother’s Day, which in the Amazon region is usually celebrated in the third week of May, coincides with the period identified as having the highest number of dengue and malaria cases. Similarly, the anniversary celebration of Puerto Esperanza takes place on September 18 and involves large gatherings, including people from neighboring communities in Colombia and Peru. Identifying these social patterns is crucial for scheduling community education initiatives and strengthening community prevention and surveillance strategies to reduce the risk of transmission of VBDs within and outside the community.

Based on this eco-health calendar, some recommendations can be made for the management of vector-borne diseases in Puerto Esperanza:

1. Synchronize vector control interventions to coincide with the beginning of the rainy season, before mosquito populations reach their peak.
2. Integrate vector surveillance with agricultural calendars to address risks of exposure during farming activities.
3. Support and strengthen traditional medicinal knowledge as a complementary approach to the interventions proposed by national VBD management programs.

4. Implement community education initiatives prior to periods of high incidence of diseases such as dengue and malaria.
5. Develop early warning systems based on environmental indicators identified in the calendar.

This calendar is a valuable tool that integrates the knowledge of the inhabitants of Puerto Esperanza with an understanding of ecological and biological aspects to create a comprehensive panorama of the dynamics of vector-borne diseases in the community. Mapping these relationships enables the visualization of the cyclical nature of these phenomena and supports the identification of critical periods for the development of community-led surveillance and control strategies for VBDs.

CHAPTER V. SOCIOCULTURAL ADAPTATIONS IN HEALTH INTERVENTIONS BY INSTITUTIONS

Sociocultural adaptation in health is considered a participatory and systematic process that aims to transform health services and institutional procedures in order to achieve more inclusive care that respects cultural differences. This process, which must be driven by all actors within the General System of Social Security in Health (SGSSS, in its initials in Spanish), needs to be flexible and adapt to the expectations of indigenous peoples, taking into account their traditional practices and knowledge in order to reduce health disparities (Urrego & Martínez, 2012).

The expectations of indigenous users are diverse and include aspects such as humanized care, the role of traditional medicine, and broader service coverage. In this context, sociocultural adaptation seeks to provide care based on values such as solidarity, respect, and reciprocity, recognizing the cultural characteristics of the users in order to improve the physical and technical aspects of health services in their territories.

Despite the efforts made by regional and local institutions and health service providers, progress in sociocultural adaptation has been uneven, as cultural, economic, and geographic barriers have hindered the implementation of effective strategies to serve indigenous populations. While some advances have been made, they have been limited by factors such as regulatory changes, resource shortages, and a lack of political will at various decision-making levels (Urrego & Martínez, 2012).

Below, the activities carried out by institutions involved in the promotion, prevention, control, and elimination of vector-borne diseases in the Department of Amazonas are described, with a focus on cultural adaptation in health care. Additionally, an analysis is provided on the progress, limitations, and key considerations in the implementation of these activities in indigenous communities.

IMPLEMENTATION OF VBD PROGRAMS WITH CULTURAL ADAPTATION

The Ministry of Health and Social Protection has defined a series of actions for programs aimed at the promotion, prevention, control, and elimination of VBDs (targeted chiefly towards malaria, dengue, leishmaniasis, and Chagas disease) which must be implemented by Territorial Entities at departmental and municipal-level. These actions include the creation and execution of plans based on an analysis of the situation relating to these diseases, allowing efforts to be focused on the most affected areas, as well as the monitoring and evaluation of these promotion, prevention, and control activities.

Additionally, these actions involve the development of sustainable and cost-effective interventions aimed at helping local communities play a more active role in identifying and managing the risk factors associated with these diseases (MinSalud, 2022). In the Department of Amazonas, institutions such as the Departmental Health Secretariat, the Public Health Office of Puerto Nariño, and the IPS (health service providers) have taken various steps to implement the actions set out in the programs.

The Departmental Health Secretariat carries out various activities for the prevention, promotion, control, and surveillance of diseases such as malaria, dengue, Chagas disease, leishmaniasis, yellow fever, rabies, and leptospirosis. One of the most important such activities consists of annual health outreach brigades, also known as “correrías,” during which door-to-door visits are conducted across all communities, villages, and municipalities in the Department of Amazonas. During these visits, fumigation is performed around homes and common areas, population censuses for the Ministry of Health are conducted, and kits containing mosquito nets, repellents, and educational materials on VBDs are distributed (Figure 14).



Figure 14. Departmental Health Secretariat activities and materials
Source: Secretaría de Salud Departamental de Amazonas (2024a)

During the home visits, the officials are usually able to interact with the family members, talk to them talking the main characteristics of these diseases and show them pictures of the vectors using the educational materials they have available. They also remind residents of prevention measures they can take inside their homes, such as using window screens, sleeping under mosquito nets, and avoiding stagnant water in uncovered tanks or buckets. Additionally, a brief explanation is provided on how to properly use mosquito nets, as explained by a staff member of the VBD Program:

“When we deliver the mosquito nets, there is always a professional present, usually a bacteriologist or a biologist, who takes charge. We explain to the person how to handle and use the mosquito net properly, because these are long-lasting impregnated nets, meaning they come with an insecticide, which is precisely what helps us kill or repel the mosquitoes that will be around... it is important to follow the recommendations. One of these is that, when opened, it should be left in the shade for a while so it can, as the saying goes, air out before being hung. It is recommended to wash it, but not too frequently. When washing it, it should not be beaten or scrubbed, because that removes the insecticide it contains, and it should not be washed with blue soap or bleach. Above all, we recommend that people do not go under the net when their skin is wet, because it often happens that they have just bathed and are still wet, then they touch the net and it causes itching—but that’s precisely because of the contact between their wet skin and the net. There were some communities that used the nets to catch rainwater [in tanks] to remove debris, so we have made a big effort to educate people not to use them [to cover tanks] because they have a chemical that could be dangerous [when it comes into contact with the water passing through the net].”

As part of the National Strategy Against Dengue - “D-Day”, the Departmental Health Secretariat has carried out activities to eliminate potential breeding sites of the *Aedes aegypti* mosquito. In neighborhoods and indigenous communities in the Leticia municipality, a cleaning kit was delivered from door to door. This contained materials such as sponges, brushes and disinfectants, together with a flyer with information on the proper cleaning of low tanks and pools, and a 2023 -2024 calendar with relevant information about VBDs.

For primary and secondary education institutions, the Secretariat has designed and implemented a pedagogical strategy aimed at raising awareness and educating the student community on the importance of preventing vector-borne diseases. This program is carried out through visits by officials to schools, where they conduct practical activities such as talks, games, and storytelling to reinforce children and young people's knowledge of personal and household preventive measures.

They have also developed educational materials such as coloring booklets that teachers can use in class with primary school children. The kit usually includes additional items such as colored pencils and drawstring bags. For high school students, they have distributed planners with dividers containing information about the diseases, pens, and drawstring bags. These materials are part of the promotion strategy, but also serve as useful resources for these children and adolescents.

The Public Health Office also makes visits to the indigenous communities within the jurisdiction of the municipality of Puerto Nariño. Officials deliver brochures and conduct door-to-door outreach to share information about vector-borne diseases and basic prevention actions. In the urban area of the municipality, they use loudspeaker announcements in the mornings to disseminate information on public health topics, including warning signs of VBDs and tuberculosis.

Meanwhile, IPS Mallamás (healthcare provider) also carries out health brigade outreach visits to the communities where most of its users live, carrying out promotional activities on vector-borne diseases and in support of the Integrated Management of Childhood Illness (AIEPI in its initials in Spanish) strategy. As explained by an official from the institution, during these health brigade visits, they provide health promotion and disease prevention services, identifying the needs of each community and focusing efforts on strengthening awareness of this topic:

“In our outreach days, we offer all the promotion and prevention services and the comprehensive health care pathways. As part of that, we begin to investigate by the community. So, we have already classified some communities where events often occur. In Yaguas - hepatitis B, and right now in Nazaret, malaria is surging, and so we provide education there about malaria. In La Libertad, we also have some events, so depending on the community, we provide certain types of education, because we can’t overload the user with too much information; otherwise, in the end, they won’t understand anything. So, we always stick to one specific topic.”

Meanwhile, the Nueva EPS (healthcare provider) has community health agents who belong to the indigenous communities. These agents are distributed based on the number of affiliates living in each community and receive training in Leticia, which enables them to carry out various monitoring and surveillance activities for vulnerable groups, such as children under five years old, pregnant women, older adults, and people with chronic illnesses. They also keep track of public health events identified in the community, such as dengue, malaria, tuberculosis, syphilis, and AIDS infections, among others.

In these outreach spaces with users, community agents distribute educational materials such as booklets and calendars (Figure 15), which they use when conducting door-to-door talks about VBDs and other topics of interest, such as breastfeeding. In the Puerto Esperanza community, there is a community agent responsible for raising awareness among users on other topics, such as preventive measures related to cleaning potential mosquito breeding sites and waste disposal.



Figure 15. Nueva EPS (health care service provider) material for VBDs promotion in Puerto Esperanza

The wide range of activities carried out by the health institutions in the department demonstrates that sociocultural adaptation represents a significant step forward in the promotion and prevention of vector-borne diseases. By tailoring strategies to the characteristics and needs of the local community, greater effectiveness is achieved in raising awareness and implementing public health practices. This approach facilitates the adoption of preventive measures and contributes to building a healthier environment, minimizing the risk of the spread of these diseases.

PROGRESS AND LIMITATIONS OF SOCIOCULTURAL ADAPTATION STRATEGIES

The campaigns for the promotion and prevention of vector-borne diseases in the Department of Amazonas have mainly focused on the distribution of protective supplies, providing information about symptoms and vectors, and raising awareness of the prevention mechanisms that can be used by the local population. Although sociocultural adaptation strategies have contributed to the goal of managing vector-borne diseases, it is important to understand the perspectives of both institutions and the local population on the impact of these campaigns in order to strengthen and complement them (Figure 16).

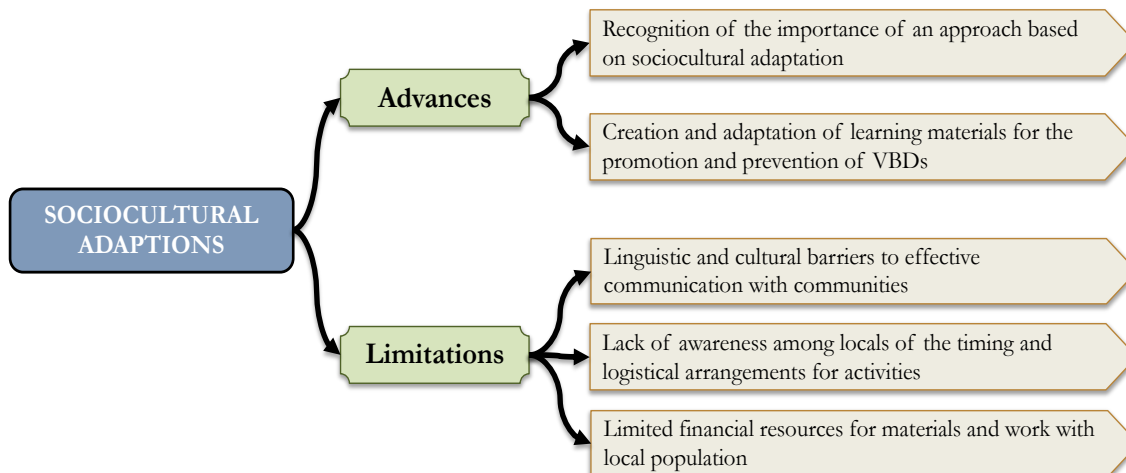


Figure 16. Progress and limitations identified in sociocultural adaptation processes

In general, institutions recognize that their identification of the need to take a sociocultural adaptation approach in the activities they carry out with indigenous communities represents a significant step forward. Unlike other departments in Colombia, the situation in Amazonas is complex in terms of multiculturalism, as it is home to a great diversity of indigenous peoples who coexist simultaneously in the territory. Institutions recognize that this situation presents unique challenges in terms of integrating the cultural, linguistic, and social particularities of the local population.

In this regard, they consider it essential that actions for the promotion, prevention, and control of vector-borne diseases are not only designed and implemented in accordance with national guidelines but also integrate a perspective that recognizes and respects the sociocultural particularities of the department. By adapting interventions to specific cultural contexts, it is sought to build trust within the communities and improve their understanding of the activities that the officials need to do, which in turn promotes greater receptiveness to the information and materials provided:

“Thank God, in most of them [the communities], they are receptive because they have already got to know the process. So, for example, they already know - ‘well ok, they fumigate, but they also bring mosquito nets, they bring repellent’ - so they see in us something they are going to receive and that will benefit them, so they are a bit more receptive. Sometimes, the most complex part is the informative aspect when, at least in my case, I have to carry out IEC [Information, Education, and Communication] activities, which means going from house to house and informing people about preventive measures, about symptoms, about identifying each disease. Sometimes they are receptive, sometimes not, because they think that is not a real solution. I mean, when we tell them they should use mosquito nets, they don’t see that as a solution. On the other hand, if we tell them, look, we are here to fumigate and we’re going to fumigate for you, they believe it, they sometimes feel that’s the real solution.” (VBD Program official, Departmental Health Secretariat).

Another step forward recognized by institutional officials is the adaptation of educational materials used with communities and educational centers. For example, the VBD Program of the Departmental Health Secretariat has focused on prioritizing and designing informational materials based on suggestions and recommendations received during health outreach visits carried out in the territory.

When designing the material, the aim is for it to be not only textual but also visually appealing and easy to understand. Officials from this program have created materials such as booklets with large images representing vectors of diseases like Chagas and leishmaniasis, focusing on symptoms and preventive measures. Additionally, they have included activities such as games and coloring-in pages that are especially designed for children, so the material can also work as an educational and recreational tool.

Over the past three years, an education campaign has been conducted in institutions throughout the department, covering both urban and rural areas. This initiative, aimed at children from various ethnic groups, has been carried out in several phases. The first phase involved setting up informational stands where students could interact with officials, receive information about VBDs and the vectors, and participate in educational activities through games.

In the second phase, informational kits were distributed to teachers, which contained resources such as games and support material on arboviral diseases, which are diseases transmitted by the *Aedes aegypti* mosquito, such as dengue, chikungunya, Zika, and yellow fever. In the third phase, teachers were trained to incorporate these topics on the promotion and prevention of vector-borne diseases into their classes.

Officials from the VBD Program consider the response from the local population to have been positive. Students recognize the work put into the program and the importance of prevention. In particular, the children show their recall of the program by referring to the officials as “the vector people... the ones who talk about dengue.” Likewise, they believe that teachers and coordinators have appreciated the effectiveness of the strategy and the impact it has generated in the educational field, stating that they are contributing to the formation of a culture of prevention in the new generations.

When making inquiries with people from the Puerto Esperanza community, it was found that 58% believe that the control and prevention campaigns in their community are effective. From their perspective, the department’s health institutions have indeed made an effort to visit their homes and provide information and protective materials. However, they are unable to clearly identify which actions are carried out by which institution, generally associating them with the Departmental Health Secretariat.

Meanwhile, in the dialogues between the community and the institutions, several aspects were identified as limitations to these processes of promotion, prevention, and control. These were: linguistic and cultural barriers, lack of knowledge about the timing and logistical

processes for the implementation of activities, and limited financial resources for materials and for working with the local population.

The multicultural nature of the department is reflected in the diversity of languages that are spoken by the elderly and primarily used within households. In this context, it is considered essential for health institutions to improve the informational materials they distribute in the communities, ensuring that they are available in the native languages prevalent in each territory. As noted by Rogelio Coello, the health promoter from Puerto Esperanza, informational material in native languages should not only focus on written text but also on oral communication, which is the traditional way of transmitting knowledge among Amazonian peoples:

“What is missing there to make it more effective? For me, well, it would be maybe producing those pamphlets in the same dialect, in the same language we speak, because... right now, they’re already publishing, there are some pamphlets already, they’re starting to arrive in the native language [from other health programs like tuberculosis]. The problem is that some people don’t know how to read it, because if I write the dialect, the letters are almost like in English. And the people who can’t read, they’re not going to [understand]... But maybe by hearing it, yes, by hearing it, they might be able to understand. For example, if they bring a pamphlet like that one [with the photo of the vectors], it could come with the title in the community’s dialect. I mean, the posters and all that — because in some families, there are people who can’t read. But they can, for example, see. So, they can see, for example, an insect.”

Adding to the problem described above, the linguistic and cultural differences between health professionals and the communities can hinder effective communication, creating barriers that prevent the proper transmission of information. Public health messages are often not fully understood, which reduces their impact and retention among members of these communities. This situation can lead to the content not being effectively integrated into daily practices. In order to ensure that messages are clear, relevant, and useful in everyday life, the people of Puerto Esperanza suggested to the institutions that, in future, they should have the support of someone who speaks the community’s native language during visits, so that they can translate the information when community meetings take place.

It is important to highlight that the institutions as a whole recognize the relevance of multilingualism in the development of health communication strategies. However, they are constrained by time and financial limitations, which make it difficult for them to reach the necessary level of coverage. In particular, the Departmental Health Secretariat, adapting its strategies for the prevention, promotion, and control of vector-borne diseases to the various languages spoken in the territory, represents a significant challenge in terms of logistics, resources, and trained personnel.

Concerning the lack of knowledge about the timing and logistical processes for implementing activities, officials state that people in the communities may feel dissatisfied with the frequency of interventions, as they believe that visits and the distribution of materials should

occur more regularly, especially for the purposes of fumigation and the distribution of bed nets. In some cases, residents have mentioned that they do not recall an official ever having visited their homes, and feel that the institutions rarely come to their communities.

In the dialogues between institutions and the community, it became evident that people were not informed about the roles of the different departments within the health institutions, or the actions they carry out in the territory and the timeframes required to organize the logistics of planned activities. For example, it is not clear to them which type of activities fall under the responsibility of the Health Secretariat (regional level) or the Public Health Office (municipal level), or what the scope of these activities is. Regarding the IPS (healthcare providers), few community members are aware that these institutions carry out educational activities on vector-borne diseases in addition to providing healthcare services in Leticia.

As stated by a staff member of the Health Secretariat, the personnel from the VBD Program must first establish a schedule of activities and have both educational and protective materials available in order to carry out their outreach visits:

“Our coverage is supposed to be 100%. So, the schedule we follow is carried out mainly over the course of a year — we’re talking specifically about the communities. In Leticia, we generally carry out fumigations twice a year. The characterization visits, which are the daily ones, going house to house, are done every day, and in the communities, they’re done during what we call ‘correría’ days, which is when the whole team goes. We travel there with both professionals and promoters, and we go with control, who do the fumigation. We also carry out population censuses to know how many people are there and how many sleeping spaces they have in order to deliver bed nets, or to hand out repellent or whatever materials we have available, because we also have to wait until those materials are available here in order to distribute them. So, in reality, this is done once a year for each community. In the schedule, it’s established that, for example, if we did a delivery last year in some communities, then this year we will carry out a population census. That way, we can identify changes because it varies a lot. We arrive in a community and we might find that now there are 10 people living in a house where there used to be 5, and so on. That information is collected across the entire department and then sent in so they know how many bed nets need to be delivered [the following year].”

The limitations mentioned above are closely linked to the scarcity of financial resources, which may be insufficient both for acquiring materials and for carrying out activities with the local population. In general terms, the responsible institutions depend on the funds allocated to implement actions for the promotion, prevention, and control of vector-borne diseases in the areas they are responsible for. This budgetary situation, which also varies according to the political will of the current government, directly impacts their ability to carry out sociocultural adaptation processes, influencing both the design and execution of interventions.

In conclusion, these limitations in terms of resources, time, and linguistic adaptations make it difficult for institutions to adopt a truly participatory approach, which is essential to ensure

inclusive and effective interventions. According to the health officials, the VBD promotion and prevention strategies implemented by their institutions in the region represent a significant step forward in terms of health education. However, they acknowledge that their activities need to be better aligned with local realities and that their approaches, in many cases, do not promote the active participation of indigenous communities.

CONSIDERATIONS REGARDING THE PROMOTION AND PREVENTION OF VBDs

The implementation of effective and sustainable strategies for the promotion and prevention of vector-borne diseases in indigenous communities represents a multidimensional challenge. However, the dialogue between the community and health institutions, as well as the recognition of their perspectives, enabled some necessary considerations to be identified with a view to promoting health campaigns that are culturally sensitive, participatory, and inclusive of traditional practices (Figure 17).

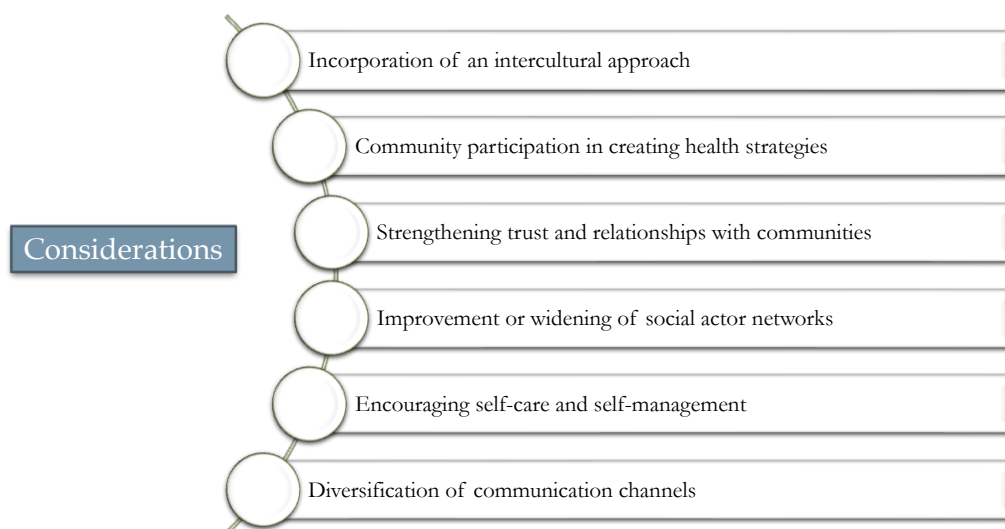


Figure 17. Considerations for the strengthening of VBD promotion and prevention processes

The first aspect to consider is the importance of progressing toward an intercultural approach for the design and implementation of activities aimed at strengthening knowledge about VBDs, their vectors, and treatment and prevention practices. In this regard, the activities should integrate the resources and practices of both knowledge systems (Western scientific knowledge and traditional knowledge) to achieve a more comprehensive, respectful, and effective intervention that addresses health needs not just from a technical perspective but also from a culturally sensitive one.

The above is directly related to the need to encourage community participation in the development of health strategies. Diseases such as dengue and malaria are deeply connected to the environment and the social conditions of Amazonian indigenous communities. Therefore, their prevention and control do not depend solely on the measures proposed by departmental institutions but also on the extent to which these practices are integrated into the daily lives of the local population.

Strengthening trust and the relationship with the communities is another crucial element to the sustainable management of vector-borne diseases. Establishing more horizontal and direct spaces for dialogue allows community members to feel heard and valued in the decision-making process. As observed by a staff member from the Departmental Health Secretariat, this type of approach to the local population fosters information exchange and improves the design of the activities proposed by institutions:

“There's one area we've identified that we need to strengthen, and that's the intercultural part, we need to somehow get to know it better, to coordinate more. Because even though we coordinate [among officials].... you know what I'm going to do, and you know I'm going to do it tomorrow, we're still missing that other part [with the communities], like, okay, let's sit down and ask: how do you need this? What exactly do you need? Do you understand this? Why does it help you or why doesn't it? So yes, that's an area we've seen we need to strengthen, and it's already being thought about in that way. Because the more we reach those shared agreements, the easier the process becomes for both of us [the institution and the community], for those doing the work and for those receiving it in some way.”

Another important consideration in the promotion and prevention of VBDs is the strengthening of collaboration networks among the various social actors involved, including traditional authorities, indigenous organizations, health institutions, universities, NGOs, communities, among others. These networks are necessary in order to understand the actions carried out by the different social actors, to identify the strengths and limitations in the implementation of these actions, and to consider the design of complementary strategies to strengthen their adoption by the community.

To avoid duplication of work and failures in the coordination of promotion and prevention actions in the communities, it is essential that the roles, responsibilities, and interventions of local, municipal, and departmental actors are clearly defined. This process enables cooperation between different institutions and community organizations, promoting a more effective and coherent response to the prevalence of VBDs in the region.

Additionally, universities and other organizations with experience in research and knowledge generation about the Amazon region can establish partnerships with indigenous organizations and communities to develop educational materials and design strategies to increase awareness and knowledge of VBDs. In this way, innovative solutions can be put forward that complement and reinforce the initiatives already being carried out by health institutions in the department.

One such partnership, which is currently gaining prominence and strength, is the one established between the Associations of Indigenous Traditional Authorities (AATIs) and the Departmental Health Secretariat. As explained by the Health Coordinator of ATICOYA, work is currently underway to train and incorporate the core indigenous team that will participate in the actions under the Collective Interventions Plan (PIC in its initials in Spanish) in the associated communities. Of these actions, one key intervention area is called "Prevention of Communicable Diseases," which includes VBDs:

"The health coordinators of the AATIs have to step in to support as ethnic liaisons. I mean, in that area, we have to, because right now with the PIC, the plan is to have a core indigenous team. So, in the core indigenous team there will be a traditional healer, a midwife, the general coordinator, the translator, and the ethnic liaison. That's five people who will go as well as the professional team [from the Department of Health], which does the promotion and prevention talks that have to do with the PIC. And the core team is there to support the intercultural aspect. Well that's where we are right now. Thank God, we achieved it after about three technical commissions where it was discussed, and only recently was it agreed that we could form that core indigenous team."

The importance of promoting self-management and self-care within indigenous communities is another consideration to take into account. Through self-management, it is sought to strengthen the organizational capacity and autonomy of communities to plan and implement actions that support the control of vector-borne diseases. In this regard, the adoption of an active role by traditional authorities, traditional medicine practitioners, and community health promoters is considered a priority, as their involvement can facilitate openness to learning acquisition of knowledge about VDBs and measures to prevent them.

As observed by an official from the Public Health Office, the health promoters play a fundamental role in disseminating knowledge about these diseases through common strategies such as loudspeaker announcements or interventions during community meetings. Additionally, they are key actors in training community members who can, in turn, share their knowledge with neighbors and family, especially regarding lesser-known diseases like leishmaniasis and Chagas disease.

This strengthening of self-management is reflected in the capacity for self-care, which involves individuals taking active and responsible measures to care for their own health and that of their families. In the context of vector-borne diseases, it is sought for community members to have sufficient information to adopt daily practices that minimize the risk of infection from insect bites and to facilitate decision-making regarding the care pathway they wish to follow in the event of suspected infection with recurring diseases such as malaria.

Finally, it is important to consider how to diversify communication channels in order to expand the reach of prevention and promotion strategies, adapt them to different audiences, and improve receptiveness to the activities carried out by health institutions. By using a variety of channels, from social media and SMS messages to community-based

communication methods, a broader spectrum of the population can be reached, including both children and adults.

In this context, the Departmental Health Secretariat conducted an information campaign at the end of 2024, with support from the institutional radio station Colombia Stéreo of the National Army and the digital radio station Tropical Amazonas. An official from the VBD program had the opportunity to share information about the dengue vector, emphasizing the metamorphosis of *Aedes aegypti* throughout its life cycle, including the stages of egg, larva, pupa, and mosquito. She also spoke about eliminating breeding sites or any items that can accumulate water, as well as making other recommendations (Secretaría de Salud, 2024a).

Identifying the main forms of community communication is crucial in these communities in the Department of Amazonas, as many have limited internet access. Moreover, messages are generally transmitted more effectively through these methods, as people tend to trust sources from their local area or that they consider to be authentic and credible. It is more likely that recommendations will be well received and understood if delivered by health promoters or traditional medicine practitioners than by outsiders to the community.

Therefore, a mixed communication strategy is proposed that takes into account the perspectives of both the communities and health institutions and combines local and digital communication channels. With the active participation of community members and leaders, this strategy could significantly improve the effectiveness of preventive and educational activities, adapting messages and materials about VBDs to the cultural and linguistic characteristics of the department. This could strengthen trust in information sources, facilitate interaction with the local population, and boost the effectiveness of preventive messages.

CHAPTER VI. PROMOTION AND PREVENTION STRATEGIES WITH AN INTERCULTURAL APPROACH

Interculturality can be understood as a dynamic social process that creates spaces for comprehensive recognition and respect for the particularities present in one or more cultures (Mendes et al., 2018). From a health perspective, the intercultural approach involves a dialogue between traditional and Western medical systems, geared towards the coordination of activities to develop the components of the Colombian health care model (Minsalud, 2017).

This process of coordination between medical systems involves developing relationships with indigenous populations that are more “parallel”, with less hegemony or subordination, in order to create an atmosphere of trust, respect, and self-determination in care practices (Aguilar-Peña et al., 2020). In this sense, an intercultural approach to health promotion seeks to overcome the historical inequalities that have affected indigenous peoples by providing more equitable access to health information and services.

Strategies for the promotion and prevention of vector-borne diseases must not only focus on the dissemination of information, but also be designed with an intercultural approach that respects and values traditional knowledge and the ways of life particular to each community. The inclusion of indigenous practices and languages in health strategies enables messages to be better understood and accepted, thereby improving the effectiveness of interventions and strengthening communities’ trust in health services.

Similarly, the prevention of vector-borne diseases goes beyond the distribution of medical resources and involves strengthening the capacities of communities so they can make informed decisions about their well-being. Strategies with an intercultural approach can reduce the incidence of these diseases and improve quality of life, while also respecting cultural diversity, promoting more inclusive health care, and strengthening the autonomy of indigenous peoples in the management of their collective well-being.

The following section describes the collaborative creation process of the key VBD promotion and prevention strategies, based on teaching-learning experiences with both adults and children, and on the dialogue space between institutions and the community. Finally, the various educational materials resulting from this collaborative process with members of Puerto Esperanza are presented.

EXPERIENCES OF THE TEACHING-LEARNING PROCESS WITH ADULTS

Knowledge-acquisition activities related to vector-borne diseases, both with adults and children, were structured around two key moments: the learning space and the teaching space. In the first space, various educational materials were used to present basic information (vectors, symptoms, warning signs) about dengue, malaria, leishmaniasis, and Chagas disease. In the second space, a range of methodological strategies were employed so that the knowledge acquired could be shared with other community members through easy-to-remember ideas, messages, or actions.

For the activities with adults, the basic principles of andragogy were taken into account. This discipline is geared towards adult education processes, using a set of methods aimed at the upgrading or deepening of their existing knowledge, as well as the acquisition and application of new information (Sierra, 2006). Following this approach, spaces were created where participants were placed at the center of the learning and teaching process (Figure 18). As a result, they were able to reflect on why and for what purpose it is important to learn about vector-borne diseases, how to apply this knowledge in their daily lives, and how to draw on their own experiences to understand and complement the information received.

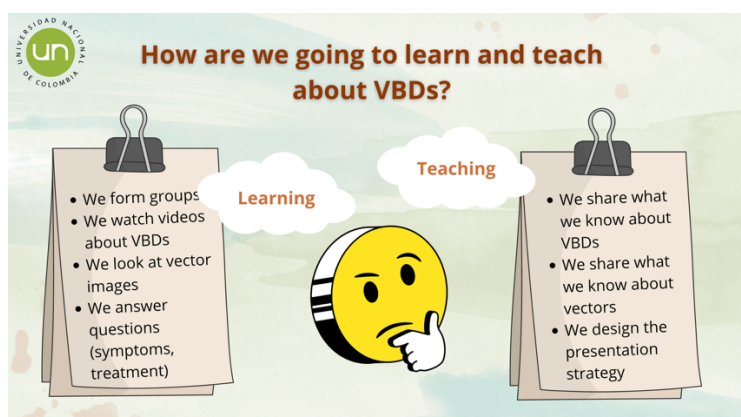


Figure 18. Summary of activities with adults for VBD knowledge acquisition

In the learning space, educational resources used included presentations on Colombia's vector-borne disease prevention and promotion programs, informational videos for each disease, and printed images of the vectors to enable their recognition. Likewise, a dialogue-friendly environment was fostered in the maloca (community dwelling space) so that any questions or uncertainties could be resolved. This was especially important for leishmaniasis and Chagas disease, as the information on these diseases was more difficult to remember given the complexity of their symptoms and the confusion surrounding the insects that transmit them.

As process of transition into the teaching space, an exchange of ideas was held regarding the local names used to identify some of the diseases and vectors, as well as to share experiences

regarding people the participants know who have had these diseases, or how the vectors have been identified within the community. For example, the health promoter shared his experience with the Chagas vector and mentioned a specific prevention mechanism related to a common practice within the community:

“I saw it with my own eyes because we picked a bunch—you know, in those bunches of milpesos and asaí [common names for palm fruits], you can see little balls there, like warts. From my experience, they say that's the poop of the insect [pito]. If we don't wash the asaí well with hot water, the procedure we're supposed to follow, we're going to get infected... Back then, when we were monitoring that, I would always catch the pito and put it in a little jar. I'd take it straight to the Health Secretariat for lab testing. I used to do that, but now it's kind of stopped—I'm not catching that little bug and taking it in anymore... I did that around 2009.”

Similarly, the exchange of ideas and experiences was important for identifying potential risks of contracting VBDs, especially from mosquito bites, and for discussing how to raise awareness about these types of situations. They also discussed ways to prevent bites from these vectors, particularly when doing agricultural activities:

“I saw the kids yesterday playing in the yard, and they sat down—one got bitten by a mosquito, and the other said, ‘let it fill up more’... kids are like that, they're very curious, and that's why it's important to give them information too... I would at least go with that kind of photograph so they can start identifying things and understand the danger. They're very curious and they tell you everything they see.” (member of the community of Puerto Esperanza)

“When you go into the wild, there's a recipe to use so the mosquitoes don't bite you. We take hog plum leaves and half a small bag of pure tobacco, and when you go into the wild you rub it on, and the mosquitoes won't come near you, not even the madre del monte will come close” (Yolbino Coello, traditional medicine practitioner)

In the first part of the teaching space, various key principles and facts were set out to reinforce knowledge about VBDs and adapt it to the specific context of the community. As a result of this dialogue, a series of ideas emerged related to the common names of diseases and vectors, traditional preventive practices, organic waste management, safe food preparation, and personal protection. These statements are listed below, and some have been mentioned and explored further in previous chapters:

- Malaria is also known in the region as terciana and, to a lesser extent, as paludismo.
- Cutaneous leishmaniasis is known in the community as “la llaga” (the sore).
- The female mosquito that transmits malaria bends or “bows” to bite.
- The female dengue mosquito mainly lives in the house of the people it bites.
- The pito or chinche is the insect that transmits Chagas disease, not “la llaga”.
- During copoazú and coconut season, we must collect the shells from the home gardens, since when it rains, water accumulates and they become a breeding site for mosquitoes.

- Before preparing asaí and milpesos, we must wash the seeds thoroughly to avoid contamination from pito droppings.
- Long-sleeved shirts and pants should be worn when going to the chagra (cultivation area), hunting, or fishing, to prevent bites from the fly that causes "la llaga."
- To repel mosquitoes from the house, you can burn chili, copal, or tocai.
- Repellents can be made with annatto, copal, and sachá ajo for use when going to the chagra, hunting, or fishing.
- Calabash and remo caspi are plants used by traditional healers to treat malaria and dengue.
- Some people who went to Peruvian communities for work or visits developed symptoms of dengue and malaria days after returning to the community.

In the teaching space, a group work strategy was used, with each group taking responsibility for conveying knowledge about the four prioritized diseases: dengue, malaria, leishmaniasis, and Chagas disease. In order to recognize the autonomy and leadership capacity of the participating adults, the team members overseeing the activity, who were from outside the community, adopted the role of facilitators.

In this way, the groups were given the freedom to make autonomous decisions about the methods and resources they would use to teach about these diseases. As a result of this process, the groups created posters with basic information about VBDs, made drawings of the vectors to facilitate their identification (Figure 19), or used the images that were provided during the learning session.

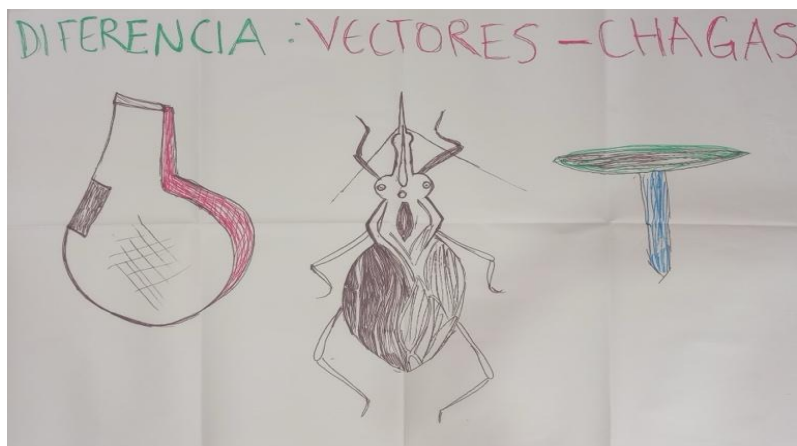


Figure 19. Graphical representation of common names for triatomines.
Left: representation of the pito. **Right:** representation of the chinche.
 Drawn by: Celso Vicente Coello

The group responsible for teaching about Chagas disease designed a graphic representation of the vector to create a dynamic activity in which participants had to identify the name most commonly used in the community to refer to the insect: *Guess the name that matches the drawing-got it? Now answer, which name sounds more familiar to you- pito or chinche?* The result of the activity showed that the name "pito" is the most commonly used one in Puerto Esperanza.

Another group, in charge of teaching about malaria, created a theatrical play showing the way the disease is transmitted and the symptoms developed by an infected person. Additionally, a traditional medicine knowledge practitioner demonstrated the steps followed when treating a sick person and showed the calabash fruit, which is traditionally used for treating this disease (Figure 20). It was notable that all the groups used and shared information from both Western and traditional knowledge with the other participants, helping their messages connect the technical concepts learned with the local understanding of the diseases.



Figure 20. VBDs teaching moments

A: Teaching about leishmaniasis, **B:** Teaching about dengue, **C:** Presentation on Chagas disease, **D:** Representation of malaria treatment with traditional medicine

The information acquired during these dialogue spaces with adults enabled the collaborative creation of educational materials aimed at facilitating the differentiation between vectors, highlighting the importance of managing organic waste for prevention, integrating hygiene practices into the preparation of traditional foods, and encouraging the use of available natural resources as repellents or for medicinal purposes. Some of these materials were used in the learning sessions with children, and two of the adult participants were involved in the activities designed for this stage.

EXPERIENCES OF THE TEACHING-LEARNING PROCESS WITH CHILDREN

The activities with children were carried out with the participation of one of the founders of the community group *Hijos de La Guara* (Chigu akügü). In recent years, this group has worked independently with children and young people in the community through educational

activities, mainly related to agriculture, to promote traditional knowledge and practices among the new generations. Both this person and another community member were part of the team that led the learning and teaching activities.

In accordance with the methodological approach, the teaching space was designed for children to take an active role in the promotion and prevention of vector-borne diseases. Through this approach, it was sought not only to share knowledge but also to recognize children as participants capable of developing their own communication strategies adapted to their community context, promoting learning and the revitalization of the Tikuna language among new generations.

In the learning space, various educational materials were used, such as animated videos for each disease, and worksheets containing a short description of each disease and an illustration of the vector. When designing these worksheets, information was used both from the academic literature and from the activities carried out with the community, including the intercultural work with adults (Figure 21).



Figure 21. Flashcards for learning about diseases and vectors

This activity was carried out using the learning stations method, for which the children were organized into four groups. Each station was led by a member of the overseeing team, who was responsible for one specific disease. The children rotated through each station, doing interactive activities using the educational materials, which allowed them to learn basic information about the VBDs identified as priorities.

To strengthen knowledge acquisition, a game called "Vector Race" was developed, maintaining the station rotation dynamic. For this game, cards with statements were created

that the groups had to identify correctly (Figure 22), earning points at each station. After several rounds, the children had the opportunity to interact with each other, which allowed them to consolidate their understanding of the VBDs in a dynamic and participatory way.



Figure 22. Card template used in the 'Vector Race' game

To conclude the learning process, a “storytelling” activity was carried out, in which members of the team theatrically narrated two stories. These stories were written taking into account relevant aspects such as regional idioms, daily activities, and the living conditions specific to Amazonian indigenous communities. The children listened to two stories: “The Flight of the Mosquito Vilma”, focused on malaria, and “The Encounter of the Aedes and Ahue Families”, based on how dengue is transmitted.

In keeping with the objectives of the teaching space, activities were designed to help the children learn about and understand the various communication channels available in their community, identify the type of audience they might address, and create effective messages they could share with both adults and other children. Through this participatory approach, it

was sought to strengthen their autonomy and their abilities as key actors in community health promotion.

To familiarize the children with the relationships between communication channel, audience and message, a dynamic game called “communication bingo” was played, where the children continued working in the same groups from previous activities. Each group received a board with different communication channels to match up with tokens representing various community actors that make up the audience (Figure 23). The communication channels and actors were defined based on continuous interaction with the community and members of the Puerto Esperanza team, further demonstrating the importance of these groups in managing VBDs.

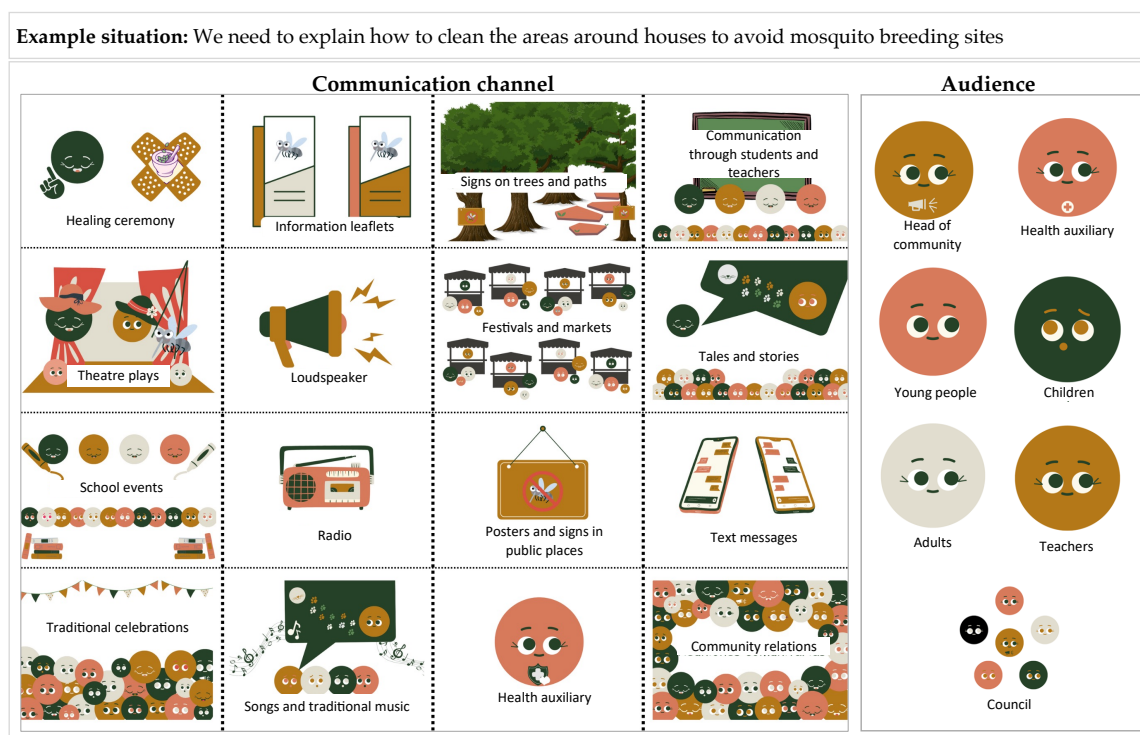


Figure 23. Communication channel and audience board for the “communications bingo”

Likewise, a situation related to VBDs was presented to the children, so they could discuss and choose the communication channel(s) they believed would be most effective for each case. Given the role of the health promoter in disseminating knowledge about VBDs within the community, it was considered necessary to identify them both as a member of the audience and as a communication channel through which children can share their messages related to care and prevention.

After several rounds of the ‘communications bingo’ game, a complementary message creation activity was carried out. The aim of this was for the children to start coming up with their own messages that they considered important to share with a specific audience, and

expressing these. Using the cards from the previous activity, each group was assigned a specific disease and three types of actors to communicate to.

The children from all groups were allocated a set time for each audience, and wrote as many ideas as possible related to the identification of symptoms associated with the diseases, the relationship between vectors and the spread of diseases, mechanisms to prevent the proliferation of mosquitoes, hygiene habits and the importance of a clean environment (Figure 24).



Figure 24. Representation of children in 'communications bingo' activities and message creation

To conclude this experience with the children, an activity called "communication strategy" was carried out, whereby they put into practice what they had learned about communication and VBDs. Each group was assigned a template containing two randomly selected audience members, to whom they had to address a specific message about the assigned VBD. When considering how best to convey the message, the children had to propose three activities along with the suitable communication channel for each one. In addition, they needed to analyze potential obstacles to carrying out those activities and suggest solutions to ensure they could be implemented successfully (Figure 25).

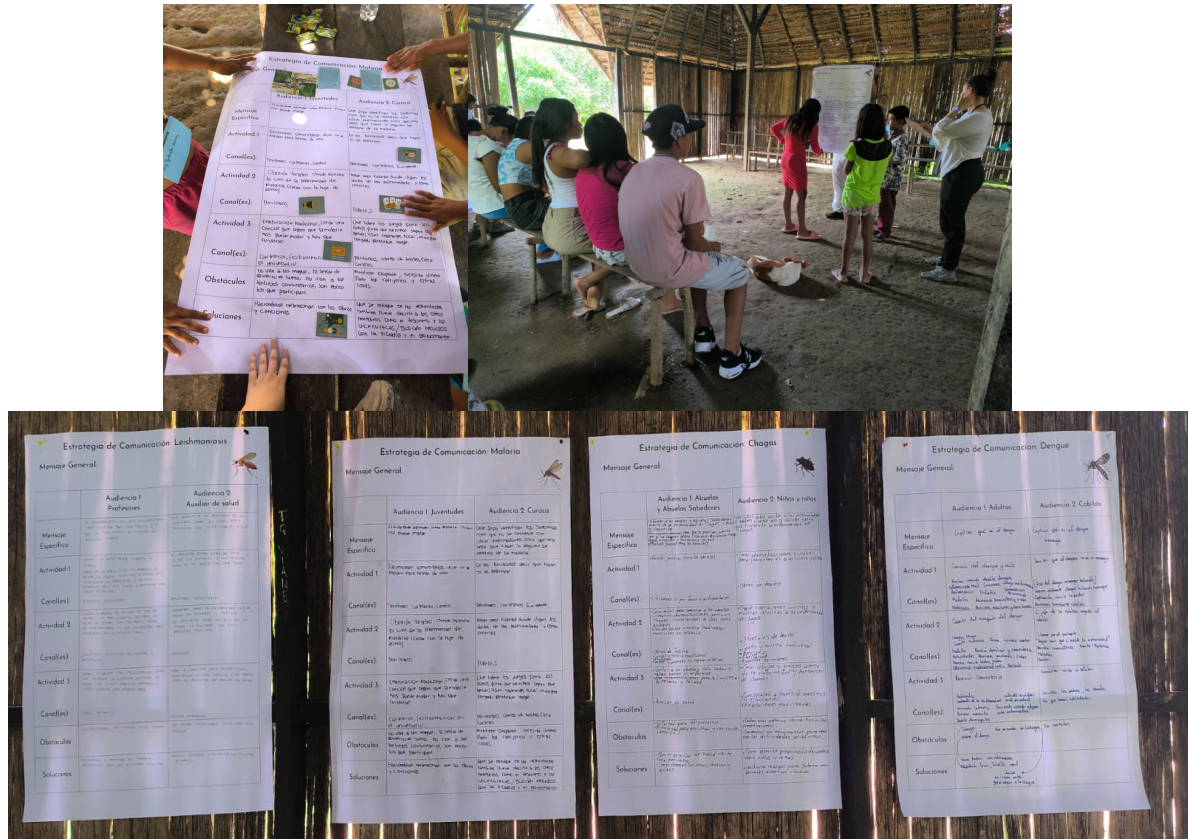


Figure 25. Communication strategies on VBDs proposed by children

Once again, the cards with communication channels and audiences were used to facilitate the children's creative process. After the groups completed the template, a dialogue space was created where they shared their ideas with their peers and discussed the common points in the messages they proposed and the activities they proposed to use to convey them.

In general, the communication strategies developed by the children focused on finding spaces for active community participation, incorporating traditional cultural elements, and combining visual methods with theatrical representation (Table 10). Additionally, they emphasized the importance of creating spaces for dialogue where messages are communicated in both Spanish and the Tikuna language.

Table 10. Communication strategies developed for the management of VBDs

Disease	Description of the strategy		
	Audience	Adults	Council
Dengue	Message	"Explain what dengue is"	"Explain what dengue is - <i>merengue</i> (form of Latin dance/music)"
	Activities	• Create a song and dance about dengue • Write a story about the dengue mosquito • Share information in community gatherings do a mosquito parade	• Joke that dengue is not merengue • Ask the curaca (traditional authority of the community) to make sure his council understands that the disease exists • Write text messages with information
	Communication channels	• Community gatherings • School events • Loudspeaker • Theatrical plays • Posters in public places	• Stories and tales • Community gatherings • Loudspeaker • Text messages
	Audience	Teachers	Health promoter
Leishmaniasis	Message	"Leishmaniasis is a disease transmitted by a fly and if we don't treat it we can die"	"Inform members of the community so they can avoid being bitten by the fly"
	Activities	• Show videos • Do the "pira" game • Word search competition • Create a theatrical play to show how someone gets infected	• Ask the health promoter to show photos of the fly • Create informational messages for the health promoter in Spanish and Tikuna • Make leaflets for health promoters to hand out door-to-door
	Communication channels	• School events • Communication with teachers and students • Theatrical plays	• Community gatherings • Loudspeaker • Information leaflets
	Audience	Young people	Curaca (traditional authority)
Malaria	Message	"It is important to learn about malaria because it can kill us"	"To know the symptoms so as not to confuse them with those of other diseases, and to know what to do if someone gets sick with malaria"
	Activities	• Discussion on this topic in community gatherings • Theatrical plays showing treatment with medicinal plants • Create a song communicating the message that malaria can kill and it is important to protect yourself	• In meetings explain what to do if someone gets sick • Make a leaflet showing that the disease is and how to protect yourself • Doing games with children so they know how to protect themselves
	Communication channels	• Loudspeaker • Posters • Songs • Anniversary party	• Radio • Loudspeaker • Noticeboards • Leaflets • Theatrical plays • Posters in public spaces
	Audience	Young people	Curaca (traditional authority)

Continue Table 10

Disease	Description of the strategy		
Chagas disease	Audience	Traditional medicine practitioners	Children
	Message	"Inform the traditional medicine practitioners about Chagas disease and who transmits it."	"Children should alert an older person or their parents when they see the <i>chinche</i> or <i>pito</i> that transmits Chagas disease."
	Activities	• General meeting for the traditional medicine practitioners • Create signs to communicate with the traditional medicine practitioners • Involve the traditional medicine practitioners as actors in dramatizations • Create songs and traditional music in the native language (Tikuna) • Visit the traditional medicine practitioners to find out if they are healthy or sick • Make recommendations for cleaning the home gardens and the house	• Create dramatizations and videos to present to boys and girls • Create stories related to Chagas disease • Create drawings and games about the disease and the insect that transmits it
	Communication channels	• Loudspeaker • Theatrical plays • Songs and traditional music • Radio stations • Posters in public places • Health aide	• Theatrical plays • Text messages • Songs and traditional music • Radio stations • School events • Traditional celebrations

Involving children in education and prevention activities of vector-borne diseases not only increases the effectiveness of public health strategies but also fosters intergenerational engagement, reinforces community autonomy, and contributes to the revitalization of indigenous languages. To achieve this aim, it is essential to adopt a health communication approach that prioritizes social interaction and active community participation, rather than relying on methods that generate one-way messages.

EXPERIENCES OF INSTITUTION-COMMUNITY DIALOGUE

In the context of indigenous peoples, interculturality goes beyond the simple translation of Western medical concepts, as it implies a true dialogue between different systems of knowledge and health practices. This approach recognizes that communities have their own conceptions of health, illness, and well-being, which are deeply rooted in their worldview.

In accordance with this approach, a meeting was held between members of the Puerto Esperanza community and officials from various institutions. Present were a social worker from the VBDs Program of the Departmental Health Secretariat, a representative from the

One Health Consortium who works with patients at the San Rafael Hospital in Leticia, and researchers from the project affiliated with the Universidad Nacional de Colombia.

The meeting began with a presentation of the progress of the activities carried out within the framework of the project, including the training process with adults and the materials created in that phase. Subsequently, representatives from the Departmental Health Secretariat and the One Health Consortium presented the activities they are carrying out regarding the diagnosis and management of VBDs in the department. At the request of the community health worker, who already knew some of the One Health officials, rapid tests for malaria and Chagas disease were brought to the meeting (Figure 26), and at the end of the meeting, the health promoter received training on how to use these.



Figure 26. Presentations by institutional officials and training on rapid tests

Through this meeting between the community and the officials, community members were able to familiarize themselves with the work of the institutions and to have their questions answered regarding the frequency of the activities carried out. For example, the representative from the Health Secretariat was able to explain how health brigades are scheduled and the personnel requirements to conduct all the communities, municipalities, and districts of the Department of Amazonas. She also explained why mosquito nets are distributed every two years and the reason for conducting a house-to-house census in the years when these materials are not distributed.

Likewise, people had the opportunity to make comments and suggestions about the educational materials that the institution distributes to families, emphasizing the need to use a second language to facilitate understanding of these materials. In turn, the official was able

to express the level of commitment expected from communities in order to strengthen health promotion and disease prevention processes related to VBDs, aiming to create synergy between institutional work and the preventive actions that individuals can carry out in their homes.

The official from the One Health Consortium shared basic information about rapid tests and the importance of their use as methods of early detection of VBDs. Although these tests do not replace laboratory exams for diagnosing diseases at the hospital, they are important in facilitating the health promoter's work in attending to possible cases and monitoring treatment prescribed by doctors or traditional medicine knowledge holders.

This dialogue space was of great importance as it allowed attendees to resolve their questions and uncertainties and improved their perception of these tests and the risks they might be linked to their use. After holding the tests in their hands and seeing them directly, people were better able to understand that these tests do not pose a risk to their health nor are they a means to illegally extract their blood. Given the history of biological material extraction among Amazonian peoples, it was clarified that the health promoter is the only person authorized to use these tests within the community and that they are disposed of immediately after being used.

EDUCATIONAL MATERIALS FOR VECTOR-BORNE DISEASE MANAGEMENT

The co-creation of educational materials on the management of vector-borne diseases is crucial to improving public health in communities. The implementation of appropriate, culturally sensitive materials in indigenous languages can play a key role in the prevention and control of these diseases, as these not only raise awareness about risks and preventive measures but also empower communities to make informed decisions about their health. Moreover, these resources help strengthen local capacity to respond to health emergencies and promote healthier hygiene and environmental management practices.

Amazonian communities like Puerto Esperanza have varying levels of access to communication technologies and resources. Some may have consistent access to the internet and mobile devices, while others rely on traditional media such as radio, television, or community posters (Figure 27). For this reason, in the collaborative creation process of educational materials it was considered how to diversify the communication channels to reach a wider audience, including those without regular access to digital platforms.

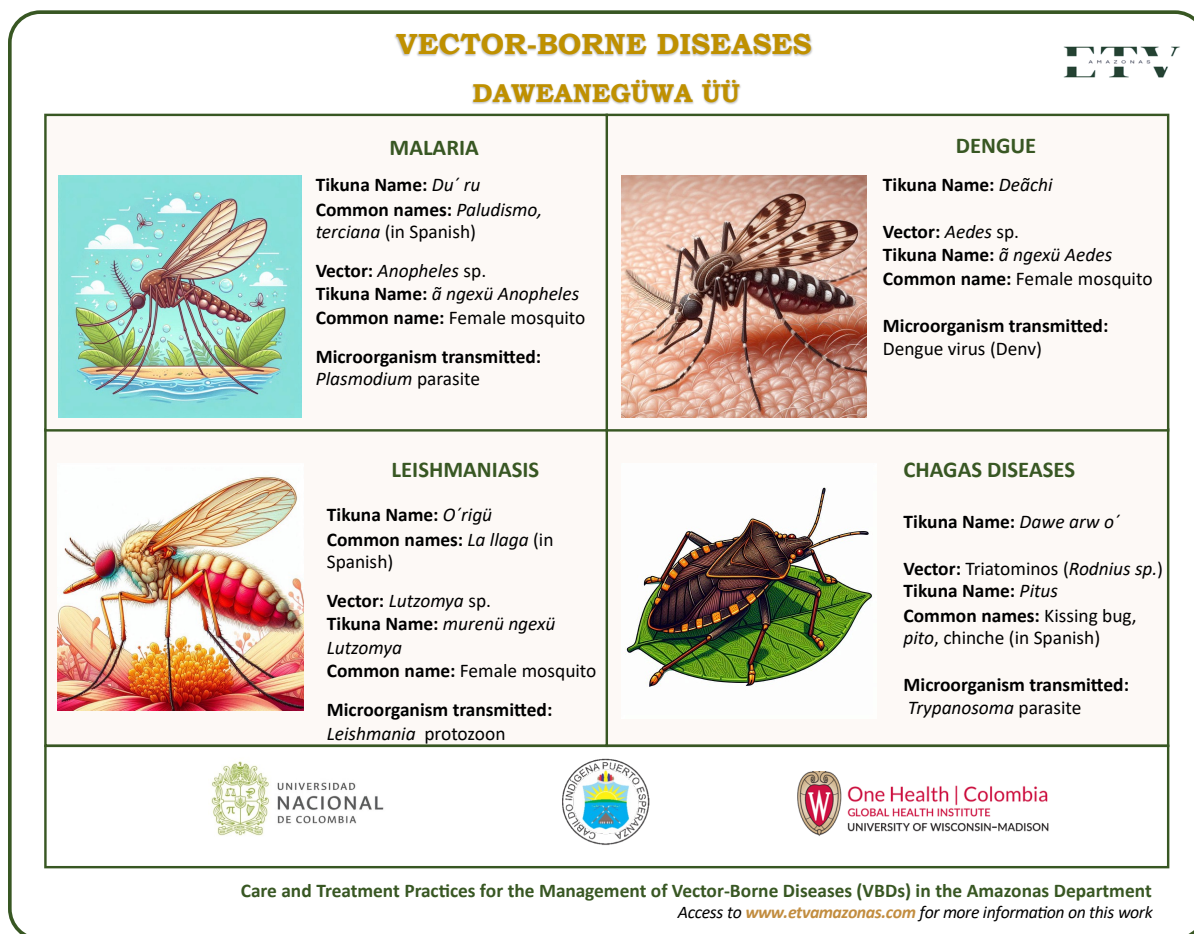


Figure 27. Informational poster about VBDs based on traditional and academic knowledge

Based on the results of the project, various infographics were created, such as those used in the teaching-learning experience with the children, along with educational resources such as the "vector game" and the illustrated cards used for this. Several posters were also designed with images and concise information about VBDs, making them easier to understand and take on board. In particular, the poster about the ecological health calendar is considered a useful tool for the health promoter and the community's traditional authority (Figure 28), as it allows them to identify the months of highest risk for disease transmission and plan preventive actions before this critical period.

A promotion and prevention message about vector-borne diseases must be adapted to the cultural, linguistic, and social context to be more effective. With this premise in mind, basic information was written about the vectors, symptoms, warning signs, and preventive measures for dengue, malaria, leishmaniasis and Chagas disease. Additionally, short texts were prepared about the plants prioritized by the community, including their common names and medicinal uses. For the children, two stories were written about dengue and malaria, namely "The Flight of the Mosquito Vilma" and "The Encounter between the Aedes and Ahue Families".

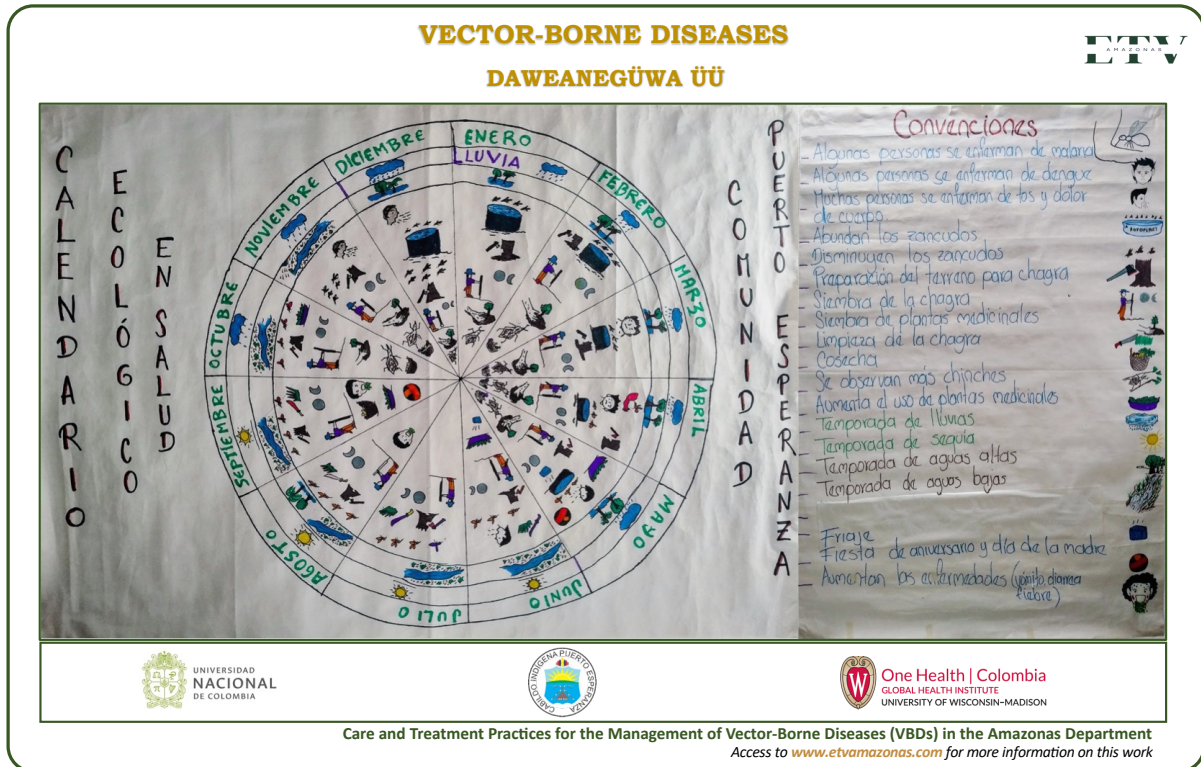


Figure 28. Information poster on the ecological health calendar

In order to broaden the impact of these messages, the texts were translated into the Tikuna language, and recordings were subsequently made in both languages with members of the community. These recordings can be shared through community channels such as loudspeaker announcements, in educational spaces like schools, and during community meetings or traditional events. It is recommended that messages in public events be delivered by those recognized as leaders in the field of health, as the population tends to trust sources of information they perceive as familiar and reliable.

Additionally, the constant repetition of information about VBDs in different formats and through different communication channels enhances its effectiveness. The goal is for the information to reach the people on multiple occasions and in various ways, increasing the likelihood that they will adopt preventive behaviors. As a dissemination tool, a booklet titled "Guardians of Health: Prevention Against Vector-Borne Diseases", containing basic information about VBDs and entertainment activities for children, such as the previously mentioned stories, coloring images, and a word search game, was designed and made available in printed and digital form (Figure 29).

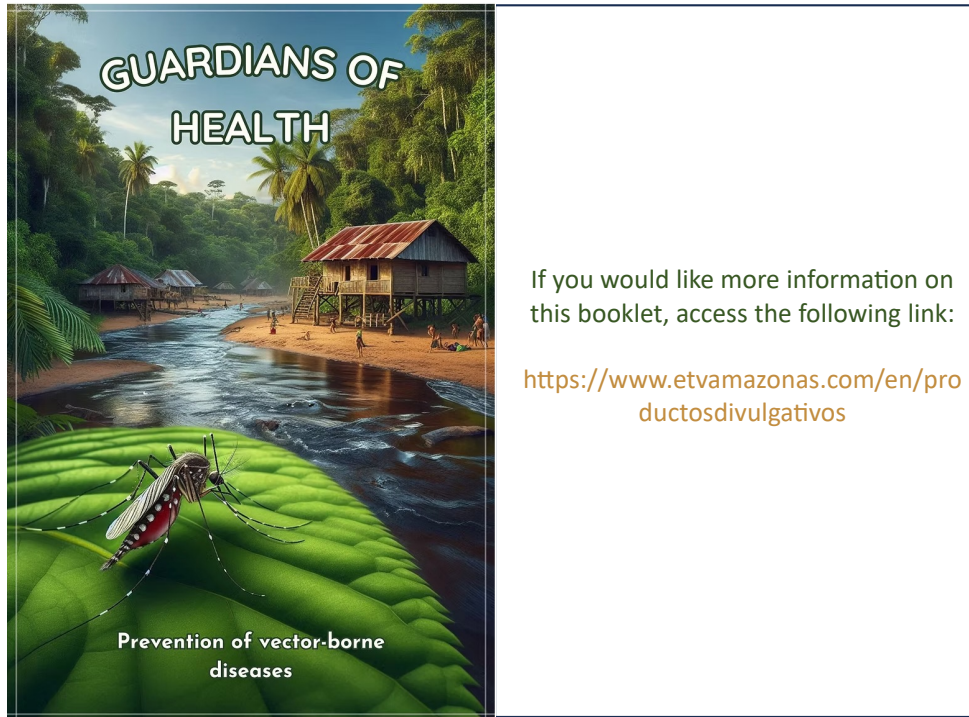


Figure 29. Access to the handbook - available online

As part of the communication process, technological channels were also explored to broaden the reach of the messages about VBDs developed with the community. In accordance with the participatory approach that characterized the entire project, it was sought to ensure that these technological tools responded to the needs and perspectives expressed by the participants themselves. This led to the idea for the podcast “Ecos de la selva” (“Echoes of the Jungle”), which is available on Spotify (Figure 30). This, although not focused exclusively on VBDs, is a valuable complement to the other resources that contextualizes and enriches the understanding of the Tikuna cultural reality in which the prevention and management practices for these diseases are embedded.

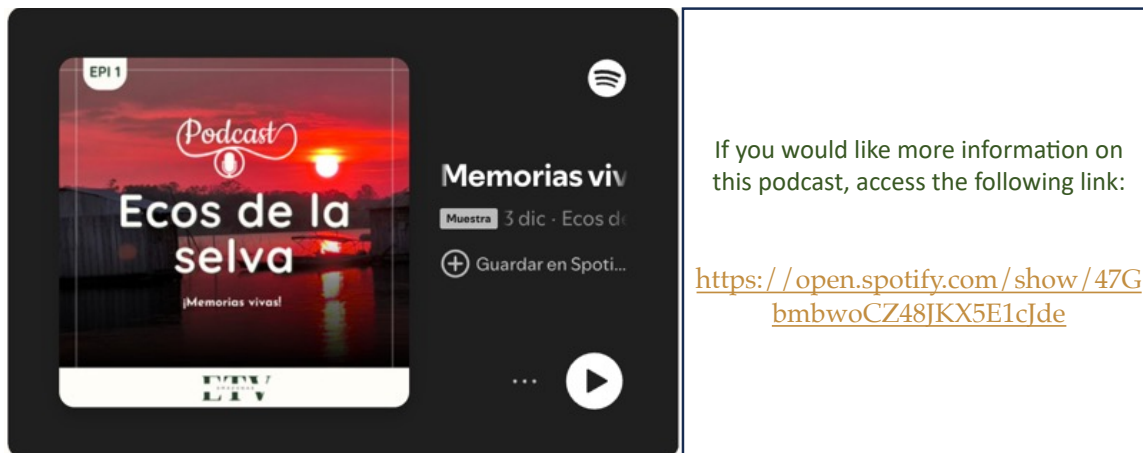


Figure 30. Access to the Spotify podcast

The podcast idea was proposed by the community, based on the importance of sharing their life stories and knowledge in their own words and using their own voices. Although “Ecos de la selva” (“Echoes of the Jungle”) is aimed at all audiences, the creators particularly have in mind people who live outside the Amazon territory or who know little about indigenous peoples. With this resource, the community hopes outsiders will be able to form a more realistic understanding of the indigenous way of life, Tikuna culture, the value of their knowledge, and the ways in which they can support VBD management strategies using their different roles in the community.

As a communication channel to expand the informational reach of the project and ensure that health promotion and prevention messages about VBDs reach the entire population in a timely, understandable, and persuasive manner, a website was also created that compiles the texts, images, and recordings created during the work with the community (Figure 31). The website contains detailed information about vector-borne diseases, which can be read or listened to in Spanish, English and in the Tikuna language.

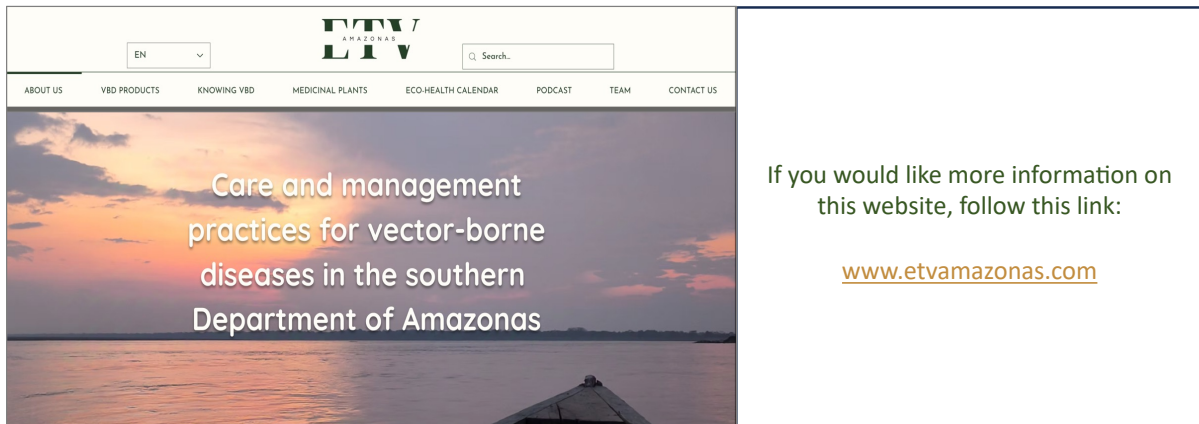


Figure 31. Access to the VBD Amazonas project website

Similarly, the website features illustrated children's stories, the eco-health calendar, access to the podcast, and a description of the working team, which consists of members of the Puerto Esperanza community and individuals from academic institutions. It also features a catalog of medicinal plants prioritized in the community, which was compiled from photographic records collected during field visits, the taxonomic identification of species, and recordings describing each plant.

As stated by Yaneth Ahue, the traditional authority of Puerto Esperanza, the teaching process on VBDs can be led from within her community or extended beyond its territory, reaching other communities through the participation of people who already possess knowledge and educational materials to lead this effort:

“How can Puerto Esperanza lead training or teaching processes about these diseases in other communities? Well, it’s very easy... well, not so easy because of the transport challenges to get to other communities. So, maybe it’s about looking at how to start

managing projects through government institutions that can come in and support us. This is a joint effort that we all need to be part of and, well, if it's led by the cabildo [indigenous council], or with our elders, being able to do the work in other communities would have a great impact, because at that point we would already be empowered by what we learned with the National University or through the talks given by the Department of Health. So, it's a beautiful thing for us to be able to share all this process that has been carried out in Puerto Esperanza with other communities."

It is important to highlight that indigenous peoples have a deep understanding of their environment and of the specific risk factors that affect their health. For this reason, including their perspectives, experiences, and ideas in the design of VBD management strategies can make these interventions more effective. However, the impact of such interventions must be strengthened through the active leadership of traditional authorities, traditional medicine practitioners, and health promoters in the implementation of the proposed activities and the development of sustainable strategies.

FINAL REFLECTION ABOUT THE MANAGEMENT OF VECTOR-BORNE DISEASES

Based on the experiences and knowledge documented in the six chapters of this informational book, several key reflections are presented on the importance of developing intercultural strategies for the management of vector-borne diseases. These reflections are focused on fundamental aspects such as the coordination of knowledge systems, sociocultural adaptation, the construction of institutional trust, active participation and autonomy of the community, the strengthening of communication, and the sustainability of knowledge.

The intercultural approach to managing vector-borne diseases is essential to achieving effective integration between Western knowledge and the traditional knowledge of indigenous peoples. This integration is manifested in practical aspects such as the inclusion of both technical and common names for diseases and vectors in educational materials, as well as the use of medicinal plants alongside conventional treatments in healthcare pathways.

This approach also involves recognizing traditional practices of prevention, protection, and surveillance of these diseases, and understanding how these practices are connected to the indigenous worldview. This coordination process not only enhances collective health in communities like Puerto Esperanza but also contributes to the appreciation and revitalization of their ancestral knowledge.

The adaptation of interventions for the VBD management to a specific sociocultural context is also fundamental to the intercultural approach. Educational and preventive strategies are adapted to local realities, taking into account daily activities, living conditions, and the specific cultural practices of Amazonian communities.

This contextualization significantly contributes to building trust between communities and institutions, overcoming historical barriers of mistrust and facilitating the effective implementation of the VBD programs of the Ministry of Health and Social Protection. To achieve this, it is essential to consolidate the network of institutional and community actors to strengthen and complement the efforts currently undertaken by health institutions in the Department of Amazonas.

Community participation and the strengthening of local autonomy are key elements in this approach. Both adults and children in indigenous communities take the role of active agents in their own learning and teaching processes, participating in the design of communication strategies and culturally relevant educational materials. This knowledge acquisition is further enhanced through bilingualism, incorporating both Spanish and indigenous languages, which enables a deeper understanding and greater adherence to preventive and self-care measures.

The sustainability of knowledge is reinforced through intergenerational participation and the use of culturally-specific materials and methods. Hence, the incorporation of traditional methods of knowledge transmission, such as songs, theater, and games, ensures that information about VBDs is not lost and is effectively shared both within and beyond the community. Furthermore, the coordination of traditional practices and academic knowledge, particularly in the use of medicinal plants, offers a promising path for strengthening local health systems and could serve as a model for other indigenous communities in the Amazon region.

While there is a wide range of methodologies and approaches for managing vector-borne diseases, it is essential that professionals from health institutions, universities, and other organizations design activities that go beyond unidirectional processes of knowledge transfer. The ultimate goal of these strategies must be the development of more inclusive, equitable, and effective health education programs that better respond to the needs and realities of Amazonian populations.

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