HONDURAS REPORT – JUNE-JULY 2006

16 of August 2006

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Terms of reference: A review of the malaria laboratory system at central, regional and local levels, and its information system was to be done by Dr Fabiana Alves and Dr Lorrin Pang as a follow-up to the Dec 2004 visit. We were to give input to the National Development Plan for the Malaria Laboratory, to review the Manual for Standard Operative Procedures for the Microscopic Diagnosis of Malaria, and to comment on the progress towards the Global Fund Goals from our 2004 visit listed below:

2004 goals:

- Reduce malaria 50% by 2008
- No (or rapid control of) falciparum malaria outbreaks
- Reduce risk of development of *P. falciparum* and *P. vivax* drug resistance
- Determine laboratory and information systems appropriate to different types of malaria situations (degrees of transmission; degrees of human migration).
- Construct a program which will be: simple, sustainable, flexible and efficient

In order to obtain data from local observations, two field visits were performed: Department of Olancho, 29 June - 01 July, 2006; and Department of Gracias a Dios, 04-07 July, 2006. Visits to the Vigilance Section of Ministry of Health (Dirección General de Vigilancia de la Salud), and the Malaria National Program were also done in Tegucigalpa in 03 July 2006. The report describes the findings/observations made during the visits; and recommendations are made based on what still needs to be done in order to reach the goals cited above.

During the entire visit we were hosted by the National Malaria Laboratory personnel (**Dr Rosa Elena Mejia Torres, Dr Engels Banegas) and Dr Jackeline Alger** of the University Hospital, so we focused on this aspect of the program.

1. ***Visit to the Department of Olancho***

A visit to the Department of Olancho was performed during the period 29 June - 01 July, 2006. This department was included in the priority malaria areas of the GFP and considered a model program. During this field activity we visited posts, starting centrally then moving towards the periphery. At each level we interviewed the responsible personnel, evaluated malaria activities and obtained data.

- Juticalpa: Hospital San Francisco, the Regional Environmental Health and Regional Lab
- Catacamas: CESAMO, local lab and Environmental Health
- Guanaja Talgua: Col Vol post

Juticalpa – This town is the capital/malaria referral center of the Department of Olancho (pop 470,000) with 23 municipalities, of which 9 are designated malaria priority areas. For the year 2005 there were a total of 3,408 confirmed malaria cases (445 falciparum). From the 2004-06 Olancho data (only weeks 1-24 for all years) there are only 5 or 6 municipalities with any significant malaria: Juticalpa, Patuca, Catacamas, San Esteban, Dulce Nombre del Culmi and Santa Maria del Real. During these 3 years about 12% of the malaria confirmed cases were caused by *P. falciparum*. For falciparum, the municipalities of Catacamas, Juticalpa, and San Esteban had the majority of the malaria cases (90% of Olancho's falciparum).

Hospital San Francisco

This is the only hospital at the Dept of Olancho (2nd level). It serves as reference for the entire department.

Staff interviewed:

- Dr Jose Leon Rivera (director)
- Dr Javier Zelaya (sub-director and epidemiologist)
- Baleska Padilla (lab responsible person)
- Jessica Munguia (microscopist)
- Nery Funes (hospital information system responsible person)
- Pablo Sanchez (information system Engineer)
- Jose Maria Galeas (information system technician)

This is a secondary referral hospital (117 beds) with all general services. According to the hospital epidemiologist (Dr Zelaya) there was an increase in the number of hospital diagnosed malaria cases (including falciparum) in the last three years, although few cases required hospitalization. There have been some cases of severe malaria misdiagnosed as dengue hemorrhagic fever, patients presenting with thrombocytopenia. Since now both dengue and malaria areas overlap the hospital has instituted a rule that all febrile patients be evaluated with malaria smears. Another differential diagnosis for fever is leptospirosis. Dr Zelaya also felt that most of the malaria patients presenting to the hospital came from the "urban/periurban" areas around Juticalpa. The

cases of malaria do not seem to cluster by family, and the Department had the capacity to do active case detection, but not the hospital. Malaria is autochthonous with cases appearing in all age groups. So far, they have not observed clinical relapses (< 28 days). After a death due to transfusional malaria they have implemented malaria smears to screen all blood bank donors. They have also implemented screening for pregnant women and found sub-clinical cases. They were not treating falciparum with primaquine and no parenteral medications were available for severe cases.

Clinical Laboratory at the Hospital San Francisco – The purpose of the malaria section of the laboratory is to perform diagnoses for the hospital and its clinics. About 2,000 smears are performed per year with a peak during the July-Oct rainy season. For the past week (week 25) there were 80 smears with 2 positive for *P. vivax*. Slides are collected in duplicate with staining and reading done by the microscopist (24 hr service). Usually there is no shortage of supplies, but there have been no lancets received from the National Malaria Program for the past 2 months and the laboratory had to request from other sources. There has been a new microscope since January. The microscopist had a 4-month training at the regional laboratory and is responsible for malaria, TB and leishmaniasis. All positive slides are labeled as positive with permanent marker. For each request of a malaria exam E-1 (non-standardized) and L-1 (standardized) forms are completed. All slides (100%) are sent weekly to the department laboratory for quality control. The most recent set of 400 slides (16 positive) sent for quality control showed 100% concordance (it must be remembered that slides are labeled as positive by the primary reader, therefore the second reader is not blinded). Since slides are read within the day and for emergencies within the hour, there is no presumptive treatment.

Information Unit at the Hospital San Francisco – Daily malaria results are entered on a weekly basis. This information shows the number of slides performed and the results (positive or negative, without species differentiation) by age groups. This summarized information is sent to the department laboratory weekly.

An information system called SIS (Sistema Integrado de Salud) is used in this hospital for individual patient entries for all patient visits. This system is Excel and Access compatible. According to the staff, the SIS system is installed on a pilot basis in the Hospital. There have been a few drawbacks that have been resolved at the local level. The long-term plan is to link all units of the hospital (including the lab) to this SIS system, so information will be available and shared in real time among all units.

Departmental Unit

This is the regional health office (for all diseases) of Olancho. This unit is supervised by the National Center and supervises the 23 municipalities of the Department of Olancho.

Staff interviewed:
- Dr Juan Enriquez (Chief, environmental health)
- Rogelio Turcios (TSA Coordinator)
- Raul Romero (TSA of Catacamas)
- Martin Ramirez (TSA of Juticalpa)
- Olga Lidia Garcia (Chief, department laboratory)

The Departmental Unit of Environmental Health coordinates with the local level (municipalities) in all public health activities. Nine municipalities were selected to be part of the Global Fund Program (GFP) for malaria. In these, the local plan of activities was integrated with the GFP plan to control malaria. GFP resources and activities started to be implemented in 2003-2004. Since then, they have received equipment, one car, 15 motorcycles, personnel resources (training of assistants, Col Vols) which helped in the strengthening of malaria control activities. However, the funding was erratic, making difficult to plan for future activities. There has been a shortage of lancets for the past two months during which febrile cases were given presumptive medication without registration forms filled or slides performed to confirm the diagnosis. This will certainly cause an underestimation of malaria cases in Olancho during this period of 2006.

Data from this office was presented previously (see 'Juticalpa' above). Three years ago imported cases from Colon might have been a contributing factor to the number of malaria cases, but now most cases are autochthonous with cases distributed across all ages and both genders. For the past three years two of the nine priority municipalities showed an increase in malaria cases, four showed no change and three showed a decrease in malaria cases. It was felt that increases in malaria were a result of a shortage of staff in specific areas such as Catacamas. The cases of dengue in Olancho have been variable with epidemics in the previous years but only a few suspected cases during 2006. Furthermore, dengue historically has been seasonal occurring during the July-Oct rainy season. It is expected that the number of dengue cases should start to increase in the next month of 2006.

The Olancho Department Laboratory serves as the reference laboratory for malaria, leishmaniasis, tuberculosis, hepatitis, other infectious diseases and anemia. There are five persons working in this laboratory. For malaria diagnosis about 200 smears are read per week from patients coming directly to this unit, from other health units without microscopy (Centros de Salud), TSAs and from the Col Vols. The slides are read the same day and results provided to the patient or sent back to the local level. They used to administer chloroquine treatment but this practice no longer continues.
In the entire department of Olancho there are 13 health units that perform microscopic malaria diagnosis, and since July 05 all the slides are sent to the dept lab weekly for QC review. They review 100% of positive slides (unblind review since a positive result is labeled on the slide) and select 10% of the negative slides randomly for review. All the reviewed slides are then

forwarded to the National Laboratory for a second QC evaluation. According to the microscopist approximately 5% of the slides are impossible to read, usually due to lack of material (blood is removed during staining) and a few due to poor staining. The QC results are sent back to the local level and if necessary corrective actions are taken (training, change microscope, etc). Residents close to the city come directly for smears since there is a general desire for diagnosis prior to therapy. During the visit to the dept lab it was found that they had lancets stored and were not informed about the shortage of lancets in the other health units.

Catacamas Health Center (CESAMO)

This is one of 23 municipalities of the Olancho department designated as a GFP priority malaria control area. There are 15 persons working in the local environmental health unit that covers the municipalities of Catacamas, Santa Maria del Real and Dulce Nombre de Culmi.

Staff interviewed:

- Dr Oscar Meza (Medical Chief)
- Raul Romero (TSA)
- Lorena Osorio (microscopist)
- Carla Francisca Jesus Castellani (Col Vol)

Of the 100,000 Catacamas residents about 40,000 live in “urban areas” and 60% live in rural areas (2-8 hours by car). Most of the malaria cases come from the “urban and peri-urban areas”. Every Monday the 25 peripheral health centers (malaria diagnosis not available) send the slides and respective M-1 form to the local lab (‘telegrama epidemiologico’). All slides are read and results returned in 1-2 weeks depending on the logistics. Treatment is given immediately when slides are taken, except at the CESAMO in Catacamas where microscopic diagnosis is performed before treatment (only positive cases are treated). Since Jan 06 there were 1,886 slides collected, 50% by Col Vols, 40% by local health units and 10% by active surveillance.

This unit is experiencing a rise in falciparum malaria since Sept 05 and has instituted active surveillance and rapid tests (PDR) for its control. For cases reported within the urban area the active surveillance was done in the 9 blocks around the house, and included interview, blood smear, malaria diagnosis and treatment for all positive slides, with or without symptoms. According to Raul Romero, for each symptomatic case detected, there were another 2-4 asymptomatic cases, all with low parasitemia, asexual and sexual forms. He points out that the active search for cases is one of the reasons for an increase in falciparum malaria diagnosed in Catacamas. Since Feb 06 the cases decreased and now it is considered under control. The use of PDR was well accepted, but had to be stopped after 3 months because they ran out of these tests.

The erratic availability of GFP resources makes planning difficult, and sometimes funds are not available when it is most needed (high transmission period). The GFP goal was to have 1 Col Vol / 200 inhabitants, but this number was considered not realistic. Currently the aim is to have at least 1 Col Vol per community with a goal of a total of 265 well trained Col Vols. Because of shortage of personnel (7 field assistants) it is very difficult to provide regular assistance to all Col Vols. Due to distance and logistics it may take a few days to 1 month for a diagnosis to be returned to the Col Vol. Patients who can afford it go to the private lab and clinics for malaria diagnosis and treatment. The local health authority has determined that private clinics should report to them all positive malaria cases.

Since 2003 there has been a dengue epidemic in Catacamas. In a recent survey, an average of 14% of the houses were infested with *Aedes* (varies from 0-50% in different areas). After malaria patients with thrombocytopenia were misdiagnosed as dengue, they have instituted that a malaria smear should be taken for all febrile cases.

Local Lab in Catacamas. The microscopist in charge of malaria for the past 12 years is Lorena Osorio. This lab is the only malaria diagnosis unit for the municipalities of Catacamas, Santa Maria del Real and Dulce Nombre de Culmi, and it is opened from Mon-Fri. Lorena is responsible for malaria readings, collect blood smear for patients presenting at the lab and gives medication. In 2006, 46% of all malaria in Olancho (381/833 cases) was diagnosed at this lab. Slides collected at the lab are diagnosed that same day. Those received from other units or TSA are read that same day or the next day (if there are more than 80 slides for reading) and results are returned to the TSA, and forwarded to the health unit or Col Vol. Approximately 80 slides are read per day in average, the peak is in July-Oct period. For example, on 29 June 06, 35 slides were read with 2 vivax malaria. About 5% of the slides received from the health units or Col Vols are very poor quality and impossible to read, usually for lack of material (washed out during staining and/or eaten by insects).

Slides collected by active surveillance are given priority and results returned in the next day to the positive cases. These slides are reported as usual: M-1 form is filled out and reported together with 'casos sospechosos'. In the last month the shortage of slide and lancets that she had ended. She was able to get some lancets from another source, but not enough to continue with regular work (the Central Lab personnel provided some lancets to the lab during our visit). Also, no L-1 forms (standardized and required) were received in the last 2 years, so photocopies were taken (at her own expense); as well as permanent pens or pencils. On examination, slides don't seem to be of a very good quality (thick smear, staining, etc). The last time Lorena had training was 4 years ago. All slides (positive and negative) are sent to the dept lab for QC. She also marks the positive slides with result (species and + parasitemia).

Col Vol post in Guanaja Talgua. The Col Vol has been trained and started to work as a volunteer 4 months ago. During this period 31 slides were taken, 7 positive (no information of species) cases were treated and all of them cured (no history of fever in the 28 days after treatment). Slides are retrieved by the TSA assistant 2-3 times/week (if there are any) and results usually returned in 1-3 days. Treatment is provided immediately when slide is collected (chloroquine 3 days + primaquine 5 days) with dosage based on age tables. For positive cases she contacts the patient and provides primaquine treatment for 14 days (independent of species). The population is very receptive especially because they have access to free medication. She knows that some fever cases might be dengue or other infections, but from her experience it is not possible to distinguish between malaria positive and negative cases by symptoms.

2. ***Review of the National Development Plan for the Malaria Laboratory and the Manual of Standard Operating Procedures for Malaria Diagnosis***

The National Development Plan for the Malaria Laboratory contains four strategic areas to be developed during five years (2006-2011). These areas are: 1) Local diagnostic responsiveness, 2) Malaria epidemiologic surveillance, 3) Operational research, and 4) Malaria National Laboratory strengthening. The plan is well organized and if conducted as planned, will strengthen the laboratory system and will provide the National Malaria Program with useful data.

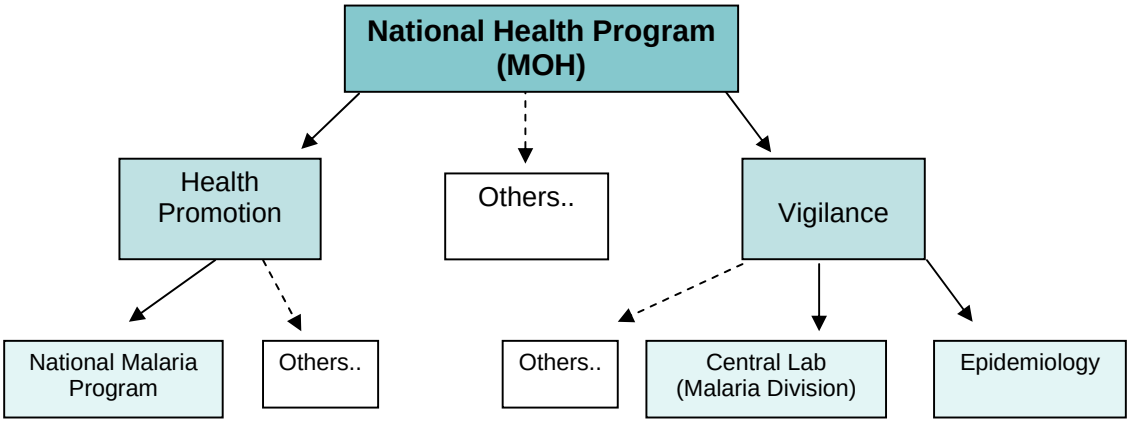
Based on the recommendations made in the 2004 visit, the Malaria National Laboratory has developed a Manual of Standard Operating Procedures (SOP) for malaria diagnosis. This manual is intended to be used as a reference guide by all health units in the country that perform malaria diagnosis. It will also serve as a training material for microscopists and other health personnel. During the visit to Olancho Department, this document was revised with the National Lab team and Dr. Alger. In general it was felt that this document is very relevant and will certainly serve for its purposes of a reference guide for all procedures related to the malaria diagnosis. It is actually very broad and not restricted to only the microscopic diagnosis technique, but also includes other methods of malaria diagnosis, the clinical and epidemiological aspects of malaria in Honduras, the follow-up and response to treatment, vigilance for *P. falciparum* resistance, information system, quality control, etc. Specific recommendations were made to the content, structure and format by reviewing the entire document. These suggestions will not be cited in this report, but they were incorporated in a revised version of the manual. It was recommended that based on this manual, a separate guide should be developed specifically for the Col Vols training and reference. The Col Vol manual can be simpler; its content should cover guidance for all activities/procedures performed by the Col Vol, and include tables for malaria

treatment (based on age and/or weight), procedures for follow-up of confirmed cases and vigilance for resistance (especially *P. falciparum*).

3. ***Visit to the Vigilance Section of Ministry of Health***

There was a meeting with the Dirección General de Vigilancia de la Salud: **Dr Jose Angel Vasquez** (director), **Dr Orles Escobar** (Vice Director), **Dra Maria Luisa Matute** (Chief, Central Laboratory).

It was explained that the malaria services come under two different sections of the National Health Programs as outlined below:



The Central Lab + malaria diagnosis labs, Epidemiology and notification of malaria cases are under the responsibility of the Vigilance Unit; while implementation, intervention and control are under the responsibility of the National Malaria Program within the Health Promotion Unit. It is clear that plans and actions should be integrated and the two parties should communicate and execute their tasks together. With this in mind, two months ago a new position under the Vigilance section was created and filled by **Lic Catalina Sherman** to link malaria activities to the National Malaria Program.

4. *Visit to the National Malaria Program*

There was a meeting with the National Malaria Program: Dr Ricardo Kafie (epidemiologist) and Dra Sonia Meraz (Malaria Program Assistant).

A new proposal has been made to the Global Fund to reduce malaria by 50% by the year 2015 rather than by 2008 (as previously proposed). A unified information system for malaria has been developed. This program is in the pilot phase of testing in 5 departments, and in a near future it is expected to be implemented in all departments of Honduras. It is planned that the

information collected in the forms (M-1, L-1, etc) is entered in the system, making malaria data available at the central level much faster. The person interviewed could not tell whether the system is compatible with Excel and/or Access. The initiative to perform diagnostics tests before therapy is too difficult in peripheral areas, especially during the rainy season where many Col Vols are isolated. In general staff of the National Malaria Program felt that the reduction of malaria will hinge on vector control rather than rapid/active surveillance based on index cases. For falciparum outbreaks there will be rapid active surveillance. There was a complaint that funding from UNDP Global Fund Project is erratic and therefore leads to unpredictable resource shortages, one of the reasons why it was not possible to reach the goal of 50% reduction by 2008. Also, the increase in total number of malaria cases in 2004 was in part due to the active surveillances performed in priority malaria areas. The implementation of the GFP resulted in different impact in malaria control in the departments according to 2004-5 data: some had a decrease in malaria cases (*e.g.* Atlantida and Colon), others remained the same (e.g. Comayagua, Gracias a Dios), and others there was an increase in the malaria cases (e.g. Islas de la Bahia and Olancho). There was a complaint that there is a problem of administrative coordination at the local level, which explains for example the shortage of lancets observed in Olancho. After de-centralization, funds received at the department level should be used to purchase their own malaria treatment and material for diagnosis.

5. ***Meeting with Dra Irma Gloria Gallo and Irina Jovel, Dept of Microbiology, National Autonomous University***

A proposal for the study of a malaria reservoir has been submitted and accepted by the Swedish (SIDA/SADEC). Researchers will be from the Honduras National University Depts of Microbiology and Parasitology Service at the University Hospital and the Karolinska Institute, in collaboration with Honduras National Malaria Program and National Malaria Laboratory/Global Fund Project. The project may be used for degrees towards Masters/PhD with the Karolinska Institute. The student Irina Jovel will take courses (Epidemiology, Statistics, Molecular Biology, Ethics, etc) at the Karolinska Institute and conduct the field-work in Honduras. Basically, the project will involve the search for, characterization of and intervention in a malaria reservoir in the La Moskitia region of Gracias a Dios. Methods will involve active surveillance with smears and PCR of both symptomatic and asymptomatic residents. Over the next few years the stages of this project will involve pre-site visit (Winter 2006), identification of the reservoir (cross-sectional studies, Winter 2007) followed by a longitudinal evaluation. If the asymptomatic reservoir is significant, a treatment intervention will be done followed by prospective monitoring (comparing to control areas) to evaluate effectiveness (magnitude and duration). Important features of the study site will be access, stability (minimal population migration), malaria seasonality, and infrastructure of the National Malaria Program at local level.

6. Visit to the Department of Gracias a Dios

Puerto Lempira (Dept Region for Gracias a Dios and Municipal Area for Puerto Lempira): - Dr Francisco Reyes Mayes (Health Promotion Unit), Dr Efrain Burgos (director, absent), Dr Macklin Espinoza (Epidemiologist Region), Dr. Orlinder Nicolas (Epidemiologist, Puerto Lempira), Mr Lenin Barahona (TSA).

The population of the Gracias a Dios department (six municipalities) is approximately 80,000 of which about half live in the municipality of Puerto Lempira (PL). In general malaria has been increasing in the past years and occurs in the town of PL itself (along with periodic outbreaks of dengue, 2004 and 2005 in the capital city). The region also has leptospirosis and leishmaniasis. The software used for data collection and presentation is MS Excel and data collection is complete and well presented. We discussed the objectives of the Global Fund Project as outlined in the 2004 summary. We discussed the objectives of the study by Dra Irma Gloria Gallo and Irina Jovel (outlined above), and requested assistance in looking for sites of where populations were stable with disproportionately lower malaria rates in older adults (indicative of a malaria reservoir and premunition). There is an extensive radio communication system within the department and municipalities use it for rapid exchange of health information, for example slide results. Travel by road and river are precarious especially during the rainy season.

Department Laboratory: There are two microscopists (Mildred Eude and Ileena Tamsin) each reading about 1,000 slides per month with about 100 positive slides (85% vivax). About half the slides are from the Col Vol and half from patients presenting to the department lab. There are no microscopists qualified for QC so all slides from the other municipalities as well as the PL municipality (all positives and 10% of negatives) are sent to the National Malaria Laboratory for QC. All positives results are labeled on the slides so there is no chance for blinded QC. About 1% of the received slides are unreadable after staining. Problems at the PL laboratory are occasional shortages of lancets and slides (few weeks per year) as well as the poor quality of old recycled glass slides. There is good communication and coordination among the municipality laboratory to rectify regional shortages. All slides are read in a day though sometimes Col Vol slides might not be delivered for reading (bad roads/rivers) for 2-3 weeks. This slow reading time results in slow response time if active surveillance is required. Laboratories are using the M1 form.

Dept Hospital Puerto Lempira: Director Dr Victor Yanez, Laboratory Director Mr Romualdo Calderon, Hospital Information System Ms Marina Alastero and Mr Valesces Domingo

With its own back-up generator the hospital has electricity 24 hours per day. The city has no electricity 2–9 a.m. The laboratory receives about 5-6 malaria

smears per day, read the same day with 5-6 positive smears per week. The entire smear is read before slides are determined to be negative. Smears can be read for the ER 24 hours per day. The technicians all read smears on a rotating weekly basis. All positives slides are labeled as positive and all are sent for QC along with 10% of negative smears. There has never been a lack of malaria smear supplies during the past year. There is good communication with the Dept Laboratory for sharing of supplies. The L1 and M1 forms are being used.

The Informatics system uses only Word and Excel. Excellent graphs and tables are produced from the M1 data sheets.

Puerto Lempira Health Department Unit: Malaria incidence (per 1,000 population) is calculated for each municipality, classified as high, medium or low – assigned colors red, yellow or green, respectively and mapped (see attached photo of map). The highest malaria areas are along the coast among fishing villages and along the interior rivers among the indigenous Moskitia natives. All of these municipalities have populations from several hundred to a few thousand. The ratio of falciparum to vivax malaria is pretty uniform amongst these two areas. Regarding the project site for Dra Irma Gloria Gallo and Irina Jovel, the coastal villages would be unsuitable for study since they have very high migration rates during the fishing season (August – March) with many of the men gone for 1-2 week periods along the coast. We were asked to instead consider the three indigenous municipalities of Sirsirtara (pop 1,226), Mocoron (pop 1,740), and Yahurabila (2,531). These communities were of the 28 (of 115) chosen for a recent active malaria surveillance. Most of the cases detected were asymptomatic. In Sirsirtara there were 6 PF and 6 PV of 54 tested. In Mocoron there were 4 PF, 6 PV and 2 mixed of 122 tested and in Yahurabila 6 PF, 4 PV and 1 mixed of 154 tested. As typical of areas of premunition only 3% of the malaria was found in the elderly (>50 years of age), although they constituted about 9% of the population.

Dr Rosa Elena Mejia and Dr Engels Banegas visited the coastal sites while the others visited Mocoron.

Mocoron CESAMO: **Gladys (nurse), Dorina Abrosia (nurse's aide), Salomon (TSA), Doctor was absent**
Mocoron is 3 hours by car from PL. It has a population of 1,700 living in 198 houses. The community is very stable without much fishing, few leave to PL for work, and occupations consist of subsistence farming. This municipality is broken up into 3 larger villages of Rondin (24 homes), Walpakiaikira (68 homes) and Mocoron. Each village has a school and is one to a few hours by foot from the other villages. Mocoron has no electricity, but there is a US NGO there with generator, internet facilities and a Guest House. It is the Norma I. Love Foundation, 5107 Atlantis Terrace, Arlington, Tx 76016, ph 817-457-6650, normamocoron@yahoo.com, www.normalove.org, www.lamosquitia.org.

Scientific meetings with local personnel: every evening there were presentations and plenary discussion sessions with the local staff, who showed motivation and enthusiastic participation. Topics were on malaria, avian flu, Hurricane Katrina, and dengue.

7. ***Recommendations***

Guidelines from the National Malaria Program. There is a need for standardized procedures at all levels, from malaria diagnosis to case management. A good start is the Manual SOP for Malaria Diagnosis that will soon be released. However, it is needed to:

- Provide malaria treatment guidelines for presumptive and confirmed malaria cases. For the confirmed cases differentiate between vivax and falciparum primaquine therapy.
- Provide malaria treatment and follow-up guideline for pregnant women.
- Currently blood banks reject donors if there is a history of malaria illness in the previous year. In addition to epidemiological screening,

standardize guideline for blood bank malaria screening (at least 1 slide, 300 fields).
- Elaborate and implement a standard notification and evaluation process for clinical failures within 28 days treatment.

Communication and Logistics – Implementation work

- Communication between the units at all levels is key. Malaria control is very difficult with shortages and even worse when shortages are unpredictable and not communicated among units.
- Provide parenteral malaria medication for secondary and tertiary centers – to be used for occasional severe cases.
- To reduce malaria, reservoirs need to be identified and eradicated. At the very least outbreaks should be controlled so that the reservoirs do not expand. The more rapid and complete the response, the better. There needs to be rapid diagnosis (as described in 2004 report) and treatment of the patient with chloroquine and FULL course of primaquine (vivax 14 days and falciparum single dose). Search for additional cases – when visiting the index case to provide primaquine: ask about other febrile cases, and collect slides from all the family members with or without symptoms. These slides also require rapid reading and feedback to the cases. For the neighboring homes, focused community education should be done so that additional cases will self report. The TSA should do a weekly review of all malaria cases to identify clusters. Environmental teams should be called in for clusters of malaria – to search for and destroy breeding sites. All these tasks have to be done quickly (~ 7 days) to reduce the amount of malaria.
- While it is true that diagnosis prior to therapy is less of a priority since chloroquine is effective for both vivax and falciparum malaria, diagnostic results (the earlier the better) should improve the compliance with anti-malarials, especially the long courses of primaquine. Furthermore, diagnosis becomes important during dengue outbreaks when poor compliance will be reinforced by spontaneous cures of the many dengue cases prescribed anti-malarial therapy. Therefore, we reiterate that all positive results should be reported to the patient and full course primaquine treatment provided.
- Have active surveillance slides reported separately. During active surveillance there are non febrile cases as well – these should not be presented together with 'casos sospechosos'.
- Reduce work load of the microscopist in Catacamas – either by hiring an assistant and/or implementing another malaria diagnosis unit in Dulce Nombre de Culmi

Lab Quality Control. Since the last visit it was pointed that quality control work should not be duplicated at Departmental and Central levels, slides review should be reviewed blinded to the result of the first reader and responsibilities of the two parties should be clearly defined. Most of these recommendations are described in the Manual of SOPs for Malaria Diagnosis,

and after lab personnel is trained on these standard procedures, the quality control system should be reliable and efficient to result in corrective actions. We still would like to highlight:

- Blind reading of slides at departmental and central levels is key for a reliable QC.
- At each malaria lab unit 100% of positive slides and 10% of negative slides should be sent for departmental QC. Negative slides for QC should be *chosen at random* (by the microscopist or TSA). At the Department labs smears should be organized and stored by week for 2 years - to permit QC by the central lab to be done by random weeks.

Information System. It was not possible to have a complete understanding of the information system developed by the National Malaria Program since the responsible person was not at the office during our visit. Still, we recommend:

- Choose software systems that are Excel or Access compatible, especially between different units. The long term goal is to have electronic entry at each malaria diagnostic unit in the health system.
- The information system should allow direct link/communication between the National Malaria Program and the National Lab + Departmental lab + all diagnostic labs at local level
- The information system should also foresee different levels of 'users', to allow persons with different responsibilities to enter, access, analyze, query data in real time.

Research Project on 'asymptomatic Plasmodium reservoir' at Gracias a Dios

- A pilot study will be conducted in Gracias a Dios, to evaluate if microscopy in active surveillance (as described above) underestimates the reservoir of *Plasmodium* infection. In this study PCR will be used in addition to microscopy to diagnose asymptomatic low parasitemic cases.
- The study for identification and eradication of the reservoir should be conducted in one of the villages of Mocoron. The other two villages as well as Srisritara municipality should serve as the control. The first stage (Masters Degree) will occur during the first year where the reservoir is described by active surveillance and PCR. The next year – PhD thesis will consist of eradication of the reservoir. And the final phase (a new candidate for a PhD program) should consist of monitoring the study site and controls to see if there is an eradication effect and how long it lasts.