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Niger: Capacity-Building Plan for Study and Control of Malaria

Niamey, Niger, September 1991

by

Raoult C. Ratard, M.D., M.S., M.P.H.
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Abbreviations and Acronyms

Pf	*Plasmodium falciparum*
Pm	*P. malaria*
Po	*P. ovale*
Pos	positive
Prev	prevalence
Ex	examined
AES	average enlarged spleen
An.	*Anopheles*
Cx	*Culex*
Loc	locality
TT	Tchin Tabaraden
TA	Tanda
KO	Kona
OR	Odds ratio
Conf. int.	Confidence interval
KAP	Knowledge, attitudes and practices
OCCGE	Organisation de Cooperation pour la Lutte Centre les Grandes Endemies en Afrique de l'Ouest
Mix	mixed infection
SR	spleen rate
PR	parasite rate
ARI	acute respiratory infection
FSO	fever of specific origin
FUO	fever of unknown origin
HDP	high density parasitemia
RBC	red blood cells
PMC	presumed malaria cases
Su	Subdivision or arrondissement
Di	division or department

Executive Summary

Malaria is probably the parasitic disease of most public health importance in Niger. It represents almost 20 percent of all infectious disease reported. The lack of current knowledge about malaria transmission and other epidemiologic features may hinder the progress of the Ministry of Public Health (MOPH) Malaria Control Project (MCP). For this reason, Niger's MOPH asked USAID/ Niamey for assistance in malaria control.

A multidisciplinary team consisting of a sociologist, an entomologist, a parasitologist and an epidemiologist/malariologist was selected for this consultancy. The goal of this activity was to prepare a detailed plan for malaria studies to be conducted in Niger.

Study sites located close to those designated as antimalarial drug sensitivity sentinel sites were chosen even though the sentinel sites were not functional. The selection of sites located near the sentinel sites is expected to bolster the sentinel sites. The following sites were chosen:

1. In the Sudanian zone, Monboye Tounga village and the Tanda dispensary, located some 20 km from Gaya. The drug sensitivity sentinel site is located in the Gaya Medical Center.

2. In the Sahelian zone, the village of Dagouajé and the Kona dispensary, located some 25 km from Tessaoua. The drug sensitivity sentinel site of Tessaoua is in the Tessaoua Medical Center.

3. In the Saharian zone, the village of Akarana and the dispensary of Tchin Tabaraden. These are located in the northern part of Tahoua division where USAID is planning to support a health project.

4. In Niamey, the district of Boukoki.

The following studies will be integrated to provide a thorough picture of the situation in each site:

- o parasitologic study with spleen and blood examination;
- o entomologic study in the village and surrounding areas;
- o sociologic study (knowledge, attitudes and practices of villagers);
- o clinical epidemiology studies at the health facilities.

It is important that studies take place at different times of the year to account for seasonal differences in malaria transmission. Case reports show an increase in rates starting in July, peaking in August or September, then dropping to the base level by December. The surveys should take place between January and May for the dry season and between August and October for the rainy season.

The field work carried out during this assignment allowed the team to decide on the methods to be used. Detailed protocols are presented in Annex 1.

It is important to keep in mind the limitations of this study. Since only a small number of sites will be investigated, the study will not give a complete picture of the malaria situation in the entire country. A comprehensive assessment would require surveys all over the country at different times of the year, which would be impossible given the scope of this work and current level of resources available.

The main benefit from this study will be the experience gained by a national team in planning activities, working out the practical application of a plan, collecting information, analyzing data and making recommendations together. Although it may be a long and cumbersome process at times, the study must be done with the full involvement of the national personnel.

As part of this assignment, the VBC team summarized all the papers written on malaria in Niger and analyzed the data from the National Health Information System on presumptive malaria cases. The analysis revealed that every year, 2 percent of Niger's population is treated for malaria at a health facility. This information is presented in Annex 2.

The malaria study outlined in the annexes is part of Niger's malaria control scheme. It is important that this study:

- o be integrated from the very beginning into the MCP activities,
- o have a strong capacity-building component, and
- o lead to other malaria control operational studies.

1. Introduction

1.1. Background

1.1.1. Malaria in Niger

Malaria is probably the most important parasitic disease in Niger. It is responsible for almost 20 percent of all infectious disease reports, with a total 500,000 to 700,000 cases reported per year (about 10 percent of the population per year). In fact, these case reports are only a small proportion of the total number of malaria cases. In some areas, practically everyone suffers from malaria at least once a year.

Malaria in Niger has been described in numerous reports such as those from Pollack (1986), Buck and Gratz (1990) and Sani (1991). Haegeman has published papers related to operational studies on malaria control in the Dosso Division (Haegeman 1985). Cot studied the development of immunity in the Sudano-sahelian zone (Cot 1988). Two clinical epidemiology studies provided some useful insights on the clinical features of malaria according to the season (Moret 1989, Ari Chebou 1989). Several studies on chloroquine sensitivity in Niger were carried out (MSP 1987, MSP 1990a, Sani 1991). In Annex 2, we present a summary of all the studies carried out in Niger. The epidemiology of malaria is constantly changing, however, and the new trends in Niger have not yet been fully studied.

In summary, the malaria situation is the following: more than 95 percent of all infections are caused by *P. falciparum*. There are three ecological zones in Niger: a Saharian zone, a Sahelian zone and a Sudanian zone. In the Saharian zone, where malaria is hypoendemic, the prevalence of infection ranges from 20 to 30 percent among children. Malaria is meso- to hyperendemic in the Sahelian zone, with rates ranging from 70 to 90 percent among children. In the Sudanian zone, malaria is hyper- to holoendemic, with rates ranging from 80 percent to 100 percent.

Niger's Directorate of Health Facilities (DES) has a National Malaria Control Program, which is described in its annual report (Sani 1991). The Directorate of Hygiene and Mobile Medicine (DHMM)'s anti-vector program is carried out by the Division of Hygiene and Sanitation (DHA). The DHMM's plan of action includes:

- Daily application of insecticide in private dwellings in Niamey. These applications are free and are carried out on demand. They use Actellic and propoxur (Baygon[R]).

- Spraying of the insecticides malathion and Actellic in the town of Niamey.

Other insecticides such as temephos and AP 3000 are used occasionally. The DHA also applies spent motor oil to ponds. In the divisions of Dosso and Zinder, Actellic seems to have been used. Details on the frequency, location and periods of application were not available. In the other divisions, vector control is not functional because of the lack of funds for equipment and insecticides. Insecticides purchased by World Bank projects and communities themselves were used for vector control, primarily in Niamey, until the past two years, when supplies ran out.

1.1.2. Need to update the information on malaria in Niger

The epidemiologic situation has changed in Niger for the following reasons:

- New strains of *P. falciparum* resistant to chloroquine have been described.

- Human activities have contributed to the expansion of sites suitable for *Anopheles* breeding such as borrow pits, agricultural development schemes, irrigation projects and dry season cultures.

- The Ministry of Public Health abandoned the policy of systematic prophylaxis for children younger than 10.

The recent trend to promote village participation and the emphasis placed on controlling morbidity and mortality instead of infection make it particularly important to gain a better understanding of some of the human factors that contribute to malaria transmission. These factors have been somewhat neglected in the past.

The information available on the malaria vectors in Niger is old and does not reflect the situation in the entire country (Smith 1981, Robert 1988). Modern methods of taxonomic classification could be used to shed new light on the species complexes found in Niger, such as *An. gambiae*. Morphological identifications are no longer sufficient and it is useful to carry out cytochemistry (on the chromosomes) and genetic studies (on DNA and isoenzymes).

The lack of current knowledge about malaria transmission and other epidemiologic features of the disease may hinder the progress of the Ministry of Public Health (MOPH)'s Malaria Control Project (MCP). For this reason, the MOPH asked USAID/Niger for assistance in malaria control (MSP 1990b).

1.1.3. Need to strengthen the capacity to evaluate malaria

The MOPH Malaria Control Program has access to a good surveillance system through the SNIS (National Health Information System) project sponsored by USAID. Few African countries have such an efficient system. Now it is important to ensure that the information entered into the system is valid. One of the important objectives of this study is to understand the deficiencies in the reporting of suspected cases of malaria. Improving the quality of the information put into the system would give the MCP the tools it needs to carry out a more effective program.

1.1.4. General objectives of the request for assistance submitted by the MOPH

The main objective expressed by the MOPH was to complete a national study on the malaria situation that would provide the baseline information necessary to develop a malaria control policy. Ideally such a study would evaluate prevalence and intensity of infection, morbidity and mortality, and all entomological features of malaria transmission.

The second objective was to evaluate the ability of the health system to deal effectively with malaria. Achieving this objective would require a qualitative and quantitative study of the control measures applied.

The third objective was to evaluate the knowledge, attitude and practices of the population regarding malaria, its prevention and treatment, and other aspects of malaria control.

To begin to meet these objectives, A.I.D. prepared a Report on Malaria Control Strategy in Niger (Carroll 1990) and the VBC Project conducted a preliminary study on a methodology for malaria surveillance in Niger (Olivar 1990). This method emphasized the evaluation of fever cases among those seeking treatment at health facilities. A detailed questionnaire was prepared and pretested. The results of this pretest showed some important differences in completion times and number of questionnaires completed by various participants. Therefore, it appeared important to take another look at the objectives of the study and to redefine the conditions under which the questionnaire would be used.

Another consultancy became necessary and the MOPH asked that this activity address the problem of evaluating malaria in Niger in a more comprehensive manner.

This study is part of the general malaria control scheme. It is important that this study:

1. be integrated from the very beginning into the MCP activities,

2. have a strong capacity-building component,

3. lead to other malaria control operational studies.

1.2. Scope of work

A multidisciplinary team consisting of a sociologist, an entomologist, a parasitologist and an epidemiologist/malariologist was selected for this consultancy.

The scope of work as defined by USAID was the following:

1. Prepare a protocol to study the malaria situation in Niger.

2. Organize a three-day workshop with Ministry of Public Health and USAID staff to plan the study protocol.

3. Carry out a geographical, ecological, demographic and logistical reconnaissance in the potential study sites (for example, Niamey, Tahoua, Tessaoua, Gaya and Tillaberi).

4. Carry out with MOPH and local representatives an introductory workshop for the planned studies.

5. Carry out limited parasitologic and clinical studies in the selected sites (about 50 per site).

6. Carry out limited entomologic studies (adult and larval collections) in each site (for example, indoor resting collections, night catches and larval collections).

7. Carry out a qualitative and quantitative analysis of the data collected in the field.

8. Organize a two-day workshop with MOPH and USAID personnel to finalize the study protocol.

9. Submit a report in English and French to USAID and MOPH and debrief them.

10. Debrief A.I.D./Washington and VBC.

2. Methodology, Development of Protocols

2.1. Principles that guided the selection of methods

The methods for describing prevalence and intensity of infection — cross-sectional surveys of a representative sample of population groups stratified according to ecological conditions — are well standardized. These surveys, which should be repeated during different periods of transmission, involve collecting information on name, age, sex and ethnic group, taking blood samples and examining spleens.

Given the limited laboratory facilities available to MOPH for blood examination, the surveys must be restricted. The alternate choice is to select a small number of villages representative of the main ecological zones of Niger. This approach would only make sense if the distribution of malaria was even over the entire zone. Since this is not always the case, however, it is important not to overinterpret the results.

Malaria incidence is difficult to measure. True incidence is the rate of the number of new malaria cases that occurred in a population during a definite period of time. Measuring incidence requires an active surveillance system and repeated parasitological surveys of the entire population or of fever cases. These surveys would entail house-to-house visits, questionnaires and systematic parasitologic examinations. Such an effort is only justified in countries where malaria control is approaching eradication. An alternative is to measure the number of cases attending a health facility. The results of such a passive surveillance, however, would only represent a small proportion of the total number of new cases. It would be misleading to call this rate of case notification an incidence rate.

The measure of malaria morbidity and mortality has not yet been standardized. Parasitological surveys do not reflect the influence of host immunity or the intake of antimalarials, both important factors in assessing morbidity and mortality. Measuring morbidity and mortality would require some special studies.

Entomological studies are aimed at defining the vector-related conditions that will influence malaria transmission. This type of survey and the forms to carry it out are well standardized. They must be done in all ecological zones of a country. Since entomological studies must be carried out by well-trained staff, they will be limited in the beginning to Niger's main ecological zones. As the capacity for entomological surveys is strengthened, more extensive surveys will be necessary. A well-equipped laboratory is indispensable for the identification of species and other tests.

There are three different approaches to evaluating the ability of the health system to control malaria:

1. Study how well the population understands malaria and its transmission, and evaluate the use of health facilities by the population. This is accomplished through population-based studies.

2. Study the management of fever cases by health facility staff. This type of survey would use a clinical epidemiology approach.

3. Study the health delivery system and its ability to implement the malaria control policy (diagnosis and treatment schemes, drug delivery system, follow-up for the detection of drug resistance, health education).

2.2. Selection of sites

Each climactic zone (Saharian, Sahelian and Sudanian) has a different epidemiologic profile. These zones are described in reports from Buck (1990) and Sani (1991). Practical considerations were essential in the selection of sites. Sites located close to Niger's drug sensitivity sentinel sites were given preference, even though these sentinel sites were not functional. The selection of sites near the sentinel sites is expected to bolster the sentinel sites.

1. In the Sudanian zone, malaria is hyper- to holoendemic, with prevalence rates of 80 percent or more. The southern parts of Dosso and Tillaberi divisions are located in this zone, where 18 percent of the population lives. Annual rainfall ranges from 500 to 1000 mm, with a definite rainy season from July to September. The Niger river flows across this zone.

   In this region, we chose the village of Monboye Tounga and the Tanda dispensary, located some 20 km from Gaya. The drug sensitivity sentinel site is in the Gaya Medical Center.

2. In the Sahelian zone, malaria is meso- to hyperendemic, with prevalence rates of 70 percent to 90 percent among children. This zone includes the northern part of the Dosso and Tillaberi divisions, the Maradi and Zinder divisions, and the southern part of the Tahoua and Diffa divisions. About 78 percent of the population lives in this area. Annual rainfall ranges from 200 to 500 mm per year occurring during a short period from July to September.

   In this zone, we selected the village of Dagouajé and the Kona dispensary located some 25 km from Tessaoua. The drug sensitivity sentinel site of Tessaoua is in the Tessaoua Medical Center.

3. In the Saharian zone, malaria is hypoendemic, with prevalence rates ranging from 20 to 30 percent among children. Although it represents 75 percent of the country's area, only 5 percent of the population lives in this zone. The Agadez and the northern part of Tahoua and Diffa divisions are located in the zone. It would be difficult to differentiate indigenous malaria cases from those imported from southern areas.

The drug sensitivity sentinel site of Arlit was not selected because it was not deemed to be representative of the population of this zone. Migrants make up a large proportion of the population. The village of Akarana and the dispensary of Tchin Tabaraden were selected instead. These are located in the northern part of Tahoua division, where USAID is planning to support a health project.

4. Niamey had to be represented in the studies because the conditions in the city are different from those in the surrounding rural areas. The district of Boukoki was selected because there is a dispensary and a maternal and child health (MCH) center in the area.

2.3. Seasonal variations

It is important that studies take place at different times of the year to account for seasonal differences in malaria transmission. Case reports show an increase in rates starting in July, peaking in August or September, then dropping to the base level by December. Surveys should take place between January and May for the dry season and between August and October for the rainy season. The rainy period may vary slightly from one year to the next. A single observation during one dry season and one rainy season probably would not be sufficient to describe all the epidemiologic patterns.

2.4. Study design

The studies will be integrated to provide a thorough picture of the situation in each site. The studies are divided into:

- o parasitologic study with spleen and blood examination,
- o entomologic study in selected villages and surrounding areas,
- o sociologic study (knowledge, attitudes and practices of villagers), and
- o clinical epidemiology studies at the health facilities

2.5. Organization of studies

2.5.1. Personnel

The studies will be carried out by an MOPH team including a coordinator for the MCP, a DEP physician epidemiologist, two laboratory technicians for parasitologic examinations, an MOPH entomologist and a mosquito collector. Staff in the divisions where the studies are going to take place, particularly a laboratory technician and the health education coordinator, will also participate.

2.5.2. Vehicles, materials, equipment and supplies

MOPH vehicles will be used. The materials necessary to carry out the studies will be purchased locally whenever available. The practical details of the upcoming studies were discussed during this trip. Entomology supplies and equipment were left behind to facilitate the work next year. A detailed inventory was prepared.

2.5.3. Data management

Study data will be entered on the SNIS computers using Dbase or EpiInfo. The statistical package used will be EpiInfo. More sophisticated statistical packages will be used if necessary.

2.6. Limitations of the study

It is important to keep in mind the limitations of this study. Because only a small number of sites will be investigated, the study will not give a complete picture of malaria in the entire country. A comprehensive assessment would require carrying out surveys all over the country at different times of the year, which would be impossible given the scope of work and resources available.

The main benefit from this study will be the experience gained by a national team in planning activities, working out the practical application of a plan, collecting information, analyzing data and making recommendations together. Although it may be a long and cumbersome process at times, the studies must be done with the full involvement of national personnel.

3. Field Observations

The team investigated potential study sites and chose the sites described below. This information was gathered by direct observation, sampling and interviews with villagers and health care providers.

3.1. Description of the selected sites

3.1.1. Village of Akarana

(Tahoua Division, Tchin Tabaraden Subdivision)

The population of the village is estimated by the chief at 500. They are Touaregs and Bouzous from the Iwilliden group and their main language is Tamasheq. Some men speak Haoussa, the regional lingua franca.

The village includes the central village and a hamlet 7 km from the village, with 76 heads of households (taxable) living in 68 households. A minority of married sons live with their families in their fathers' households.

All the men are monogamous. The number of children per woman seems to be lower than in sedentary villages.

Founded in about 1965, the village was extended around a nucleus made of the school for nomadic children (started in 1974) during settlements of nomads threatened by the droughts of 1974 and 1984. After losing their herds, some families stopped moving around in their leather tents and settled into mud houses in Akarana. The village chief, who belongs to a lineage of traditional chiefs, was elected at the time of the settlement.

The primary school started in 1974 includes a boarding school for nomadic children. (The village health worker originally worked in the school.) According to the village chief, there are now 78 pupils, including all the school-age children from Akarana. Students

admitted to secondary school continue their schooling in Tchin Tabaraden. There is an alphabetization center in Tamasheq where adults learn to read and write using the official tifinar writing. Created in 1985, it is active every other year. Two midwives and 21 men are attending this center.

Sheep, goat and cattle breeding is done by herdsmen who stay away from the village for long periods. After the drought of 1984, some saw their herds waste away and they have been poor ever since. Others were able to keep a pair of animals and have tried to continue herding.

Dry season vegetable gardens are tended during part of the dry season along the ponds until they dry up. Part of the crop is consumed locally and the rest is sold at Tchin Tabaraden. Other occupations of the villagers include craftsmen, traders, tent repairmen and weavers. Akarana has no market. There is a market at Tchin Tabaraden on Sundays.

The village has two wells of 12m diameter close to the pond, which dries up around the month of November. If herdsmen bring their cattle to Akarana instead of Tiguiddam Tessoum, the pond dries up faster.

As seen by the villagers, their health problems are miscarriages, sterility and infant deaths. As seen by the author, the main health problems are malnutrition and lack of hygiene.

The village chief is one of two marabouts, or traditional healers who treat with Koran verses. These marabouts will treat fever with koranic cocktails (koranic verses are written down and the ink is washed away into a cocktail to be swallowed) or by writing texts on amulets. There are no leaf doctors, but everyone knows some recipes for leaf or bark medicines and some are good for fevers and stomachaches. Drinking goat's or sheep's urine is considered an efficient remedy against malaria.

Modern treatment is available at the Tchin Tabaraden Medical Center. The Expanded Program of Immunizations (EPI) is carried out once a year, but no maternal and child health services are available. Akarana is located 15km from the medical center. Taxis

are 1,000 FCFA for a return trip. The closest pharmacy is in Tchin Tabaraden.

Akarana has one village health worker (VHW) and two midwives. Women do not always call in the midwives because mothers often help younger women deliver.

The Akarana VHW was trained in 1974 at Tchin Tabaraden and took continuing education (CE) courses every three years, with the last update in 1990. Before 1990, the VHW received all the drugs at the CE seminars and distributed them free of charge to patients. In 1990 he was told to sell aspirin and chloroquine so that he could purchase more to renew his stock. The resupply of drugs is not continuous because the VHW has difficulty recovering costs and obtaining discounts on the drugs he buys. The people have complained about the system. They no longer ask the VHW for other care because he is often out of supplies.

Mosquitoes are present at the beginning of the rainy season until the Harmattan, a seasonal wind, blows in. People sleep on the roof to protect themselves from mosquito bites (the trick being not to fall down) and use mosquito nets.

Traditionally people believed that malaria during the rainy season was caused by drinking too much fresh milk. The villagers did not believe health personnel who told them that mosquitoes transmitted malaria. After the 1984 drought, however, there was no milk to drink and when the rains came back, they brought mosquitoes and malaria.

The village chief, who is also the marabout and does consultation, has some modern knowledge about malaria. He encourages villagers to take chloroquine and to seek treatment at the medical center. The majority of respondents in our own survey now recognize that malaria is carried by mosquitoes and have positive feelings towards mosquito nets. Some link fever and convulsions to malaria. They use cold showers to lower fever.

The presence of a VHW is an asset for malaria control despite his shortcomings and problems with supplies. Malaria is not well recognized and is sometimes confused with other fevers. The older

generation and the Bouzous have less knowledge of malaria. All ignore the link between malaria and miscarriage. No one mentioned malaria prophylaxis during pregnancy. Mosquito nets are used by adults only. People cannot afford to transfer patients to health facilities and have a hard time purchasing drugs or mosquito nets.

3.1.2. Village of Dagouajé

(Maradi Division /Tessaoua Subdivision)

The population is estimated at 1,000. The village is primarily Haoussa, with a few Fulani and Bouzou families. Villagers belong to three Haoussa subgroups, Daoura, Gobir and Beri Beri, but all speak Haoussa. The predominant language is Haoussa.

Five districts surround the central nucleus of the village. There are 78 heads of household. More than one-third of the men are polygamous (26 have 2 wives, 4 have 3), and 43 men are monogamous. There is no seclusion of married women.

The village is located in the Sahelian zone 25 km from Tessaoua, 4 km from the large village of Kona and 50 km from Nigeria.

Founded around 1930, Dagouajé was prosperous in the 1970s when peanuts were farmed and sold. The village was part of a Kona cooperative, but cooperative activities stopped in 1984 and the villagers became cash poor.

The villagers' religion is Islam but they also have limited magical beliefs.

Boys attend one of four koranic schools. Toki primary school is located 4 km away but only eight boys attend. There are about 15 men literate in Haoussa.

Villagers' occupations include farming of millet, sorghum and peanuts, herding of goats, sheep and cattle, and trading. There are about 10 traders. During the dry season, men migrate to Nigeria (Kano). The women tend the household, farm, and raise cattle and children. Some have additional duties, including sale of doughnuts, millet ball and peanut oil. There is no market in the village itself.

There are two wells in the village and two in the hamlets. Seven temporary pools, which dry up in October, are used for cattle drinking and brick making.

The food supply consists of millet, sorghum, peanuts, meat and milk.

Childhood diseases mentioned by villagers in order of importance were measles, diarrhea and convulsions. Scabies and skin infections are very common. The mothers mention hematuria in children. Health problems observed include obvious schistosomiasis, with numerous *Bulinus* intermediate hosts in ponds well-suited for transmission. Malnutrition is obvious in many children in spite of adequate food supply. It appears that the people prefer to sell their food to Nigeria for cash. Hygienic conditions are poor but animals are kept away from the houses.

The village has 10 marabouts, including six who specialize in medicine, and seven leaf doctors, including two who specialize in malaria. Some of these traditional healers combine koranic, magical and leafy methods.

The Kona dispensary is located 4 km away. People go there on foot. Medical emergencies are handled by donkey cart ambulances. The Tessaoua pharmacy is 30 km away.

Village health workers were named in 1965. Two midwives were trained in 1979 and last took a course to update their skills in 1987. Two VHWs were trained in 1979 and their training was updated in 1988. The midwives deal with deliveries. The VHW do some health education and minor health care. They manage to maintain their drug supplies by selling drugs on the neighboring markets. The VHW knows the old dosage of chloroquine.

The villagers complain about mosquitoes, which are around from the beginning of the rainy season to the end of October. Adults use mosquito nets, but their use is declining as the economic situation worsens. Mosquito nets from Nigeria are cheaper but of lower quality. Some people say that using a mosquito net as a sheet will reduce the number of bites.

Villagers' knowledge of malaria is fairly good. The preferred treatment is chloroquine and aspirin from the VHW. When the disease persists, villagers go to the dispensary. Leaves are used in tea form or mashed in paste to be applied on the body. The price for three chloroquine tablets is 25 FCFA.

Some villagers believe malaria is caused by humidity, rain or dew, others think the culprits are the sun and heat, and others blame field work and effort. Some villagers see a linkage between convulsions and the rainy season. A few think convulsions are associated with fevers. They also link miscarriages with fevers. A vertical cut on the forehead is accepted practice for treating convulsions. Throwing a child on the thatch roof of a round hut and catching him or her before the child falls to the ground is a substitute method of treatment. Both may be combined for severe cases.

The village's malaria control assets are the dispensary in the area, the VHW team, and the open attitude of the chief and traditional healers towards modern medicine. The older alphabetized men trained at the time of the cooperative could also help. The drawbacks are the impoverishment of the population, the invasive procedure used to treat convulsions and the numerous other diseases found in the village.

3.1.3. Village of Monboye Tounga

(Dosso Division/Gaya Subdivision)

The population of 2,100 is divided into 1,000 Dendi, 650 Haoussa and 450 Fulani. Haoussa is the common language.

The village consists of a central Dendi village and two peripheral districts (Fulani and Haoussa). The Dendi village has 118 households and 160 families. The majority of men are monogamous.

Monboye Tounga is located on the banks of the Niger river at the Benin border 20 km north west of Gaya and 5 km from Tanda. It was founded in 1934 by the family of the chief. The village's prosperity was based on fishing. For the last 10 years, fish have been scarce. From 1981 to 1987, the Tara integrated project

(USAID, Africare) organized a fishing cooperative and alphabetization courses.

Villagers' religious beliefs include Islam and animism. There are two koranic schools, one with 80 pupils and the other with seven. The primary school has 102 pupils and is attended only by Fulani and Haoussa children. An alphabetization center was active during the days of the cooperative.

The village economy is based on traditional sorko fishing. Fish are sold in Niamey. Now fishermen must go further to catch their fish, up to Benin and Nigeria. Fulani breed cattle. Food crops are sorghum, millet, corn, beans and peanuts. The village has a mill, which alleviates the women's work. The market is on Saturday.

Drinking water comes from wells. The river is also used for drinking water. Villagers eat fish, millet, sorghum, meat and milk.

Health problems mentioned by the people include malaria, respiratory infections, measles, diarrhea and vomiting. Observed health problems include bad skin hygiene and early marriage with high natality and infant mortality. There is no obvious malnutrition.

The village has four marabouts, who are also leaf doctors, two leaf doctors, including the village chief, two zimas who heal mental problems with rituals, one VHW who is also a leaf doctor, and one knot specialist, who heals convulsions.

The Tanda dispensary is located 5 km away. Dispensary staff members also carry out EPI activities in the village. The ambulance service is by donkey cart. Villagers complain about chronic lack of drugs at the dispensary. Drugs prescribed are available only at the Gaya drug depot (taxi return trip to Gaya is 500 FCFA).

The VHW team consists of two VHWs and two midwives. One VHW is also a leaf doctor. He believes in a synergistic and holistic approach, combining chemotherapy, zima and leaves. He maintains his drug supply by selling drugs on the market.

Villagers' knowledge about malaria symptoms is fairly good. Leaf medicine is used first. If leaf medicine fails, the VHW and chloroquine are sought. Three tablets of chloroquine cost 25 FCFA.

Beliefs about the causes of malaria are numerous: millet processing, change in seasons, mosquitoes. Convulsions are attributed to the rapture of the soul by a sorcerer, genie or spirit. The treatment of choice for convulsions is to have knots tied around the neck or waist. Zimas prefer fumigation. Leaf doctors prepare teas from leaves or weeds. Marabouts heal with prayers, spit and word cocktails. The VHW is the lone dispenser of chloroquine.

The village's assets for malaria control are the generalized use of mosquito nets, the relative wealth of the population, the good nutritional status of the villagers, good school attendance, the VHW team, the dynamism of the zima leaf doctor VHW, who has a holistic approach to medicine, and the proximity of the dispensary. The drawbacks are the low level of malaria knowledge, the difficulty of obtaining drugs, and poor hygienic conditions.

3.2. Results of sociological surveys

3.2.1. KAP schematic comparison

The sample of 27 respondents who answered the "Knowledge, Attitudes and Practices" questionnaires in the communities and health centers is too small to confer statistical significance. The KAP results, however, revealed some contrasts between the different localities, which should be verified during the larger survey in early 1992.

In the communities, the bias of this preliminary survey was toward older men ("deciders") and toward the households near a survey's starting point, which was either the house of the chief or a village center. In the dispensaries respondents tended to be women (generally mothers) bringing in febrile children. Respondents in the dispensaries included a minority of government employees and people from other regions.

The expectation was that those interviewed in the dispensary would be better informed about malaria and more inclined to use modern medical methods than respondents in communities. This was often the case, but a large number of the dispensary respondents said that they did not know the answers to the survey questions. A summary of the KAP study methodology and results is presented in Annex 3.

3.3. Results of the parasitologic survey

3.3.1. General results

The parasitologic survey included 258 people, 236 of whom were children ages 0 to 9. The overall results are presented in the following table. Prevalence of infection was high at around 65 percent. There were no important differences between the villages. *P. falciparum* was the most common species, followed by *P. malariae*.

		P. falcip		P. malar.		P. ovale	
Village	Ex	Pos	Prev	Pos	Prev	Pos	Prev
Akarana	62	41	66.1	0	0.0	1	1.6
Dagouajé	105	69	65.7	18	17.1	8	7.6
Monboye	91	59	64.8	5	5.5	3	3.3
Total	**258**	**169**	**65.5**	**23**	**8.9**	**11**	**4.3**

Comparison by village for prevalences: $X^2=0.03$, df=2, p=0.98

3.3.2. Age and sex distribution

The survey focused on children ages 0 to 9. There were no significant difference in prevalence between age groups. There was no difference by sex either.

	Males			Females			Total		
Age	Ex	Pos	Prev	Ex	Pos	Prev	Ex	Pos	Prev
0-1	33	23	69.7	40	25	62.5	73	48	65.7
2-9	81	54	66.7	82	55	67.9	163	109	66.8
10-19	3	2	66.7	3	3	100.0	6	5	83.3
>19	7	2	28.6	9	5	71.4	15	7	46.7
Total	**124**	**81**	**65.3**	**134**	**88**	**65.7**	**258**	**169**	**65.5**

Comparison by age group 0-1 yr and 2-9 yrs: $X^2=0.03$, p=0.86
Comparison by sex: X^2 Mantel Haenszel stratified by age=0.00, p= 0.98

The distribution by age group and village showed no major differences between villages:

	Akarana			Dagouajé			Monboye		
Age	Ex	Pos	Prev	Ex	Pos	Prev	Ex	Pos	Prev
0-1	12	8	66.6%	40	27	67.5%	21	13	61.9%
2-9	28	21	75.0%	65	42	64.6%	70	46	65.7%
10-19	6	5	83.3%	0	0	----	0	0	----
>19	16	7	43.7%	0	0	----	0	0	----
Total	**62**	**41**	**66.1%**	**105**	**69**	**65.7%**	**91**	**59**	**64.8%**

3.3.3. Splenomegaly

Spleen examinations showed an increase in the prevalence of enlarged spleen and spleen size with age. The spleen rate went from 31 percent to 51 percent (significant difference , $X^2=10.0$, $p=0.001$). The average enlarged spleen (AES) index went from 1.62 in infants to 1.85 in children (difference not significant, Anova $F=2.25$, $p=0.13$).

The comparison of spleen rates by sex showed no significant differences ($X^2=2.02$, $p=0.15$). Infected individuals did not have larger spleens than noninfected ones ($X^2=1.10$, $p=0.29$); The average spleen for infected individuals (all spleens included) was 0.96 versus 0.76 for th[illegible]-infected ones; this difference is not significant (Anova F=[illegible]2, p=0.23).

Spleens by age group					Spleens of 2 - 9 year olds by village				
Age	Ex	Fos	Prev	AES	Village	Ex	Pos	Prev	AES
0-1	101	32	31.7	1.62	Akarana	28	11	39.2	1.63
2-9	194	99	51.0	1.85	Dagouajé	96	51	53.1	1.94
Total	**295**	**131**	**44.4**	**1.80**	Monboye	91	45	49.4	1.49
Sex					**Infection**				
M	92	42	45.6	1.83	Infected	109	58	53.2	1.81
F	102	57	55.8	1.87	Non inf	54	24	44.4	1.70

3.3.4. Fever

With fever defined as a temperature greater than 38°C, the prevalence of fever was similar among infected and noninfected people (respectively 9.4 percent and 10.1 percent, $X^2=0.02$, $p=0.93$). Even after analysis restricted to the 2- to 9-year-olds, there was no difference: the mean temperature was 37.1°C among those who were infected and 36.9°C among non- infected children (nonsignificant difference, Anova $F=0.57$, $p=0.54$). Considering the higher fevers of 39°C or more yielded the same picture. The odds ratio of infection among feverish individuals was 0.93 (confidence interval 0.37 to 2.40). Fever was a poor predictor of malaria infection in this survey. (This should not be over-interpreted. In particular, it may not apply in outpatient settings.)

Prevalence of fever according to infection

	Ex	Fever 38+	Prev	Fever 39+	Prev	Mean temp
Infected	169	16	9.4%	5	2.9%	37.1
Not infected	89	9	10.1%	4	4.5%	36.9
Total	**258**	**25**	**9.7%**	**9**	**3.4%**	

3.3.5. Parasite density of infected individuals

Infants and children had high parasite densities (3,729 and 3,220 infected red blood cells (RBC) per mm^3). The lower densities observed among older children were not significantly different from those of infants (Anova F=0.216, p=0.64). Teenagers and adults, however, had much lower densities in the range of 250 to 700 (Kruskal Wallis H=9.83, p=0.02).

The comparison of parasite densities by village was done on the homogeneous group of children ages 0 to 9. The parasite densities in the villages of Akarana and Monboye were low in comparison with those of Dagouajé; however, these differences were not significant (Anova F=0.79, p=0.54).

Among infected individuals from 0 to 9 years old, the comparison of parasite densities according to temperatures showed a density of 2,994 among afebrile individuals versus 6,737 among fever cases (fever defined as T>38°C). This difference was significant (Anova F=5.2, p=0.02). The logical conclusion is that among infected individuals, fever is likely to be due to malaria.

Among these same children ages 2 to 9, an enlarged spleen was not related to parasite density (3,200 versus 3,500, Anova F=0.064, p=0.79).

Age	Pos	Parasite /mm^3	Std devn	Village (2-9 yrs)	Pos	Parasite /mm^3	Std devn
0-1	48	3729	7129	Akarana	29	2510	6174
2-9	109	3220	5932	Dagouajé	69	4066	6121
10-19	5	240	89	Monboye	59	2993	6590
>19	7	742	936				
Total	**169**	**3153**	**----**		**157**	**3375**	**----**
Spleen							
Normal	83	3255	5248				
Large	74	3510	7343				

3.3.6. Conclusion

This preliminary work was useful to determine some of the parameters to be included in the final study. Age, sex, spleen examination, thick and thin smear should be included. Temperature measurement did not provide very useful information and slowed down the work. Questions about fever during the past month and travel outside the village yielded results that were so unreliable they were not usable.

3.4. Results of entomologic survey

The entomologic survey was carried out in Niamey and in the three other selected sites and their immediate surroundings.

3.4.1. Akarana - Tchin Tabaraden

Larval collections

Collections were made at eight sites: four around the village of Akarana, three along the road to Tchin Tabaraden and one at Tchin Tabaraden. These sites represented four types of habitat.

Habitat type	Density		Water	Frequency	
	Algae	Vegetation		*An.*	*Cx.*
1-Borrow pits	+	+++	turbid	>90%	<10%
2-Ponds	++	++	clear	55%	45%
3-Foot prints	0	0	turbid	<30%	>70%
4-Swamp	+	++	clear	0%	100%

0 none, + low, ++ abundant, +++ very abundant

The immature stages of *Anopheles* collected belonged to the complexes *An. gambiae* and *An. pharoensis*. *An gambiae* was collected in seven of eight sites and *An. pharoensis* in three sites, mostly in borrow pits in association with *An. gambiae*.

Only one site, a clear-water swamp with abundant vegetation, did not have any anopheline larvae.

Indoor resting collection

Indoor resting collections were made in five households in the village of Akarana. The total number of *Anopheles* was 25, including 18 females and 7 males, with an average of five *Anopheles* per house. Morphological identification showed that all specimens belonged to the *An. gambiae* complex.

Dissection of the midgut and salivary glands of five females of *An. gambiae* yielded negative results. The female parous rate was 100 percent.

3.4.2. Dagouajé - Tessaoua

Larval collections

Collections were made at seven sites: five sites around the village of Dagouajé and two in the town of Tessaoua. These sites represented four types of habitat.

Habitat type	Density Algae	Density Vegetation	Water	Frequency *An.*	Frequency *Cx.*
1-Foot prints	0	0	turbid	100%	0%
2-Pistia* ponds	++	++	clear	60%	40%
3-Borrow pits	0	+++	turbid	>60%	<40%
4-Ditch	+	+	polluted	0%	100%

0 none, + low, ++ abundant, +++ very abundant

**Pistia*, an aquatic plant, can reduce pollution in polluted waters.

The immature stages of the *Anopheles* collected belonged to the *An. gambiae* and *An. pharoensis* complexes and the species *An. rufipes*. *An. gambiae* was collected in six of seven sites. *An. pharoensis* was found in one borrow pit and *An. rufipes* was collected in a pond with *Pistia*. In the latter type of breeding site, *An. rufipes* was four times more abundant than *An.*

gambiae. The ditch was the only breeding site with no anopheline larvae because the water was too polluted.

Indoor resting collection

Indoor resting collections were made in five households in the village of Dagouajé. The total number of *Anopheles* was 10, including eight females and two males with an average of two *Anopheles* per house. Morphological identification showed that all specimens belonged to the *An. gambiae* complex.

Dissection of the midgut and salivary glands of five females of the *An. gambiae* complex yielded negative results. The female parous rate was 80 percent.

Nocturnal collection

Adult *An. funestus* were collected at night in the guest house where the team stayed in Tessaoua.

3.4.3. Monboye Tounga - Gaya

Larval collections

Collections were made at three sites in the village of Monboye Tounga. These sites represented three types of habitat.

Habitat type	Density Algae	Density Vegetation	Water	Frequency *An.*	Frequency *Cx.*
1-River side	+	++	colored	>90%	10%
2-Rice paddies	+	++	colored	<40%	60%
3-Borrow pits	0	++	colored	0%	100%

0 none, + low, ++ abundant, +++ very abundant

The immature stages of *Anopheles* collected belonged to the *An. gambiae* and *An. pharoensis* complexes, and to the species *An. ziemanni*. A large number of *An. pharoensis*, along with a few *An. gambiae* and *An. ziemanni*, were collected in a sorghum field flooded by a branch of the river. In rice fields, *An.*

pharoensis and *An. ziemanni* were collected in equal numbers, but no specimens of *An. gambiae* were found.

Indoor resting collection

The indoor resting collection was limited to three households in the village of Monboye Tounga because of the great densities of anophelines found. The total number of *Anopheles* was 186, including 103 females and 83 males, with an average of 62 *Anopheles* per house. Morphological examination showed that all specimens belonged to the *An. gambiae* complex.

Dissection of the midgut and salivary glands of five females yielded negative results. The female parous rate was 100 percent.

3.4.4. Niamey

Larval collections

Collections were made at six sites: two in the elevated part of Niamey and four along the Niger river. These sites represented five types of habitat.

Habitat type	Density		Water	Frequency	
	Algae	Vegetation		*An.*	*Cx.*
1-Pond/footprint	0	0	turbid	100%	0%
2-Borrow pit	0	0	turbid	100%	0%
3-Niger river	0	++	turbid	>90%	<10%
4-Rice field	0	+++	turbid	>50%	<50%
5-Pond	+	+	turbid/ polluted	0%	100%

0 none, + low, ++ abundant, +++ very abundant

All the anophelines collected in Niamey belonged to the *An. gambiae* complex. Specimens were collected in five of a total of six sites. The only site negative for anopheline larvae was a pond with polluted water. All mosquitoes collected in the pond/footprint and borrow pit were *An. gambiae*. Along the

Niger river, 90 percent of the mosquitoes collected were *An. gambiae* and 10 percent were *Culex*. In rice fields, *An. gambiae* (>50%) was associated with *Culex* (<50%) in more equal numbers.

3.4.5. Conclusions

Sahelo-saharian and Sahelian zones

An analysis of the small entomological surveys conducted in Akarana-Tchin Tabaraden (Sahelo-saharian zone), Dagouajé-Tessaoua and Niamey (Sahelian zone) shows that two types of *Anopheles* larval habitats are common. These were borrow pits and footprints at the edges of ponds, swamps, puddles and other bodies of water. Although *Anopheles* were always present in these bodies of water, the proportion of *Anopheles* and *Culex* varied. Most of the species collected belonged to the *An. gambiae* complex. The second most common group of species collected was *An. pharoensis*, which was found in association with *An. gambiae* in borrow pits.

The *An. rufipes* species was collected in large numbers, along with a few specimens of *An. gambiae*, in a pond with *Pistia* at Tessaoua. The association between *Anopheles* and the aquatic plant *Pistia* has been mentioned often in the literature. There is always a negative association between *Anopheles* and polluted water, as was observed in the ditches surrounding the main well in Dagouajé and in one pond in Niamey.

Unlike the village of Monboye Tounga and the city of Niamey, which are located along the Niger River, the villages of Akarana and Dagouajé do not have permanent bodies of water.

Sudanian zone

In the Sudanian zone, represented in our study by Monboye Tounga - Gaya, three types of habitat were commonly found: branches of the Niger river, rice fields and borrow pits. There were always *Anopheles* in the first two types of habitat. Specimens of An. *pharoensis*, along with a few *An. gambiae* and *An. ziemanni*, were collected in rice fields in equal proportions.

Surprisingly, the borrow pit did not have any *Anopheles*. This borrow pit was unusual, however, because it had not been used for a long time, was filled with fish, and did not have the same turbidity as the other borrow pits in the area.

Our entomological survey was the first time to report *An. ziemanni* in Niger, although this species occurs in other West African countries (Gillies and Coetzee, 1987). This finding constitutes a new country record and will be published as a note in the taxonomic literature for the anopheline fauna of Africa.

Location	*Anopheles* Adults	*Anopheles* Larvae	Preferred type of larval habitat
Akarana/ Tchin Tabaraden	*An. gambiae*	*An. gambiae*	Pond, borrow pit foot print
		An. pharoensis	Borrow pit
Dagouajé/ Tessaoua	*An. gambiae*	*An. gambiae*	Borrow pit, foot print
	An. funestus	*An. pharoensis*	Borrow pit
		An. rufipes	Pond with *Pistia*
Monboye Tounga/Gaya	*An. gambiae*	*An. gambiae*	Branch of river
		An. pharoensis	Branch of river, rice field
		An. ziemanni	rice field
Niamey	-----	*An. gambiae*	Borrow pit, foot print, river, rice field

Anopheles densities per house in indoor resting collections varied from 0 in the elevated part of Niamey to two in Dagouajé to five in Akarana and 62 in Monboye Tounga.

All the dissections made on *Anopheles* collected indoors yielded negative results, but this was not surprising given the small sample size tested. Sporozoite rates of 0.7 percent and 1.4 percent (Baudon 1986) have been observed in Tillaberi. Consequently, at least 100 females would have to be dissected to ensure that a single infected mosquito would be found. It is important to remember that the objective of this survey was to test the techniques that will be used in the study planned for 1992, not to obtain representative samples.

Travel conditions made it difficult to keep adult *Anopheles* alive. During the 1992 study, we suggest that *Anopheles* dissections be made at the collection sites so that a sufficient number are available to study the rate of malaria infection in mosquitoes. The researchers will need to bring along a dissecting microscope. Arrangements could be made with the parasitology team members to use their compound microscope.

3.5. Results of epi-clinical studies

3.5.1. General results

The number of fever surveillance forms completed was 10 at the medical center of Tchin Tabaraden (TT), 13 at the Kona dispensary (KO) and seven at the Tanda dispensary (TA). A total of 30 forms were completed and 27 blood samples collected.

Locality	Forms filled out	Blood samples	Positive	Prevalence
TT	10	7	7	100%
KO	13	13	10	77%
TA	7	7	5	71%
Total	**30**	**27**	**22**	**81%**

The majority of the forms were filled out by nurses (23), physicians (6) or midwives (1).

3.5.2. Description of the outpatient population

The number of outpatients interviewed was 27, including 17 males (63 percent) and 10 females (47 percent). Their age group distribution was as follows: 10 percent infants from 0 to 1 year of age, 25 percent children from 2 to 9 years, 20 percent older children from 10 to 19 years, and 45 percent adults.

Only a minority of the children were attending school: 37 percent of the 2- to 9-year-olds and 17 percent of those 10 to 19 years. The main occupations of adult patients were homemaking (4), farming (1), cattle breeding (1), and fishing (1). The majority of children (55 percent) and adults (65 percent) were illiterate.

The ethnic distribution of outpatients varies according to the site:

Loc	Haoussa	Djerma Songaï Dandi	Touareg Bella Bouzou	Fulani	Arab	Total
TT	4	0	4	0	2	10
KO	11	0	0	2	0	13
TA	0	7	0	0	0	7
Total	**15**	**7**	**4**	**2**	**2**	**30**

3.5.3. Origin of consultations

The majority of patients were self-referred or came with a family member. Only two were referred from elsewhere. In general, patients come from the village where the health facility is located. Few come from the surrounding region. The time between the onset of symptoms and attendance at the health facility was longer in Kona, where the proportion of regional outpatients was higher. The difference in mean durations between onset of symptoms and health facility attendance was marginally significant (Anova Kruskall-Wallis $H=4.85$, $p=0.08$), probably because of the small sample size.

The average duration of disease depends on the origin of the patient. Patients from the village itself had been ill for 2.7 days before they sought treatment at a health facility, while patients from the region had been ill for 5.7 days (Anova F=3.41, p=0.07, a marginally significant difference).

Loc	Origin of outpatients Village	Region	Nomadic	Length of disease
TT	7	3	0	2.2
KO	8	5	0	5.1
TA	6	1	0	3.0
Total	**21**	**9**	**0**	

3.5.4. Prevalence of malaria

Malaria prevalence by age group and by sex was the following:

Age	Male Exam	Male Pos	Male Prev	Female Exam	Female Pos	Female Prev
0-1	5	5	100%	0	0	--
2-9	5	4	80%	2	2	100%
10-19	1	0	0%	4	4	100%
>19	6	4	67%	4	3	75%
Total	17	13	76%	10	9	90%

3.5.5. Symptoms

All outpatients said that they had fever. (This was one of the conditions for selecting an outpatient for this study.)

	Not infected		Infected		OR	Conf. int.	Fisher ex. p=
Headache	4/5	80%	16/22	72%	0.67	0.02-9.6	0.61
Chills	4/5	80%	7/22	32%	0.12	0.00-1.6	0.07
Vomiting	1/5	20%	10/22	45%	3.33	0.25-93.9	0.30
Diarrhea	0/5	0%	7/22	32%			0.19
Sweat	3/5	60%	10/22	45%	0.56	0.05-5.55	0.46
Burning urine	0/5	0%	7/22	32%			0.19
Back ache	1/5	20%	10/22	45%	3.33	0.25-93.9	0.30
Dyspnea	1/5	20%	1/22	5%	0.19	0.00-9.10	0.34
Cough	0/5	0%	1/22	5%			0.21
Skin infected	0/5	0%	3/22	13%			0.52
Temp >38	2/5	40%	16/22	73%	4.00	0.38-48.8	0.18
Malaria diagnosis	5/5	100%	20/22	91%			0.65

3.5.6. Clinical signs: spleens and temperature

The mean spleen size was 0.60 among uninfected individuals and 0.20 among infected individuals. This difference was not significant (Kruskal Wallis H=0.18, p=0.18).

Spleen size	Not infected	Infected
0	4	17
1	0	2
2	0	1
3	1	0
Total	**5**	**20**

The mean temperature of infected individuals was 38.6° versus 37.8° for noninfected individuals. This difference was not significant (Kruskal Wallis H= 1.71, p=0.18).

3.5.7. Parasite density

A comparison of parasite densities of infected individuals by age and fever category showed no significant differences.

Age	Exam	Parasite density	Standard deviation	
0-1	6	3466	4940	
2-9	7	2685	3017	
10-19	5	8080	7733	Comparison by age:
>19	7	2028	2793	Anova F=1.85, p= 0.16
Fever				
None	6	4300	5837	Comparison
>38	19	3600	4790	Anova F=0.08, p= 0.77

3.5.8. Treatment

Four pregnant women were examined, but none of them had taken chloroquine prophylaxis. Only two of the patients said they had taken chloroquine before coming to the health facility, and both were still infected. Only one patient said he had gone to a traditional healer. The validity of these results are doubtful. It is possible that the nurses who asked the questions did make an effort to elicit the correct answer.

The antimalarial treatments administered are presented in the table below. The majority of patients (89 percent) received medication to reduce fever (usually aspirin). Most patients were treated on the spot (44 percent) or treated and given a prescription (56 percent). Preventive advice was given in only 65 percent of cases. Weird treatment schemes were used: chloroquine was administered as a single dose, and quinine was used in doses well below those recommended. No effort was made to persuade patients to switch from IM quinine to oral chloroquine when vomiting stopped. A

commonly used treatment was three days of injectable quinine IM at insufficient doses (8 mg/day instead of 25 mg/day).

Treatment	# Treated	Dose/Schedule	# Treated
Chloroquine	11	1 day at 10 mg/kg	6
		3 days at 10-10-5 mg/kg	5
Quinine IM	12	1 day at 6-8 mg/kg	8
		3 days at 6-8 mg/kg/day	4
Chl + Qui	2	1 day at 10 mg/kg chl et 6-8 mg/kg qui	2

3.4.9. Conclusions

The number of questionnaires filled out was too small to draw definitive conclusions. The purpose of this exercise was not to carry out a definitive study but to test a method and an instrument. From the preliminary results it appears that outpatients coming from remote areas have been ill for longer than patients from the village where a health facility is located. The analysis of signs and symptoms seems promising and will probably yield some interesting results with a larger sample size. These preliminary results already show some major deficiencies in the therapeutic schemes used.

4. Itinerary

September

5/6 Preparation of a plan for the protocol of study on malaria situation in Niger at VBC/Washington.

9 Discussion of the scope of work at USAID/Niamey with Nancy Lowenthal, Child Survival Project Officer, and Carl Abdou Rahmaan, Health Development Officer.

Discussions at MSP/Niamey with Dr. Hamissou Maoudé, Directeur Direction des Etablissements de Soins (DES), Mr. Ibrahim Magagi, Directeur Direction des Etudes et Programmation (DEP), and Mr. Maiga Abdoulaye, Secrétaire Général Adjoint.

Preliminary workshop with the MSP and USAID personnel to discuss the study protocol. Present: Nancy Lowenthal USAID, Dr. Ibrahim Magagi, Directeur DEP, Dr. Mounkaila Abdou, Médecin Epidémiologiste, DEP, El Hadj Sani Zaqui, Coordinateur, Programme National de Lutte contre le Paludisme (PLP), Mr. Fouta Aboubacar, Entomologiste, PLP, Mr. Boureima Seidou, Parasitologue, Ecole Nationale de Santé Publique (ENSP).

10 Planning workshop: Preparation of the clinical study protocol and planning of field visits.

Visit to the Parasitology laboratory of Ecole Nationale de Santé Publique (ENSP).

September

11 Visit to the National Health Information System (SNIS): Mr. John Isard. Obtained information on the number of presumed cases of malaria.

Arrival of the entomologist. Discussion of the entomologic aspects.

Planning workshop: Preparation of parasitologic study protocol.

12 Visit to Organisation de Lutte contre l'Onchocercose.

Planning workshop: Preparation of sociologic study protocol.

13 Visit to Hôpital Central: Dr. Develoux, Parasitologist.

Visit to the Centre of the Organisation de Coopération pour la Lutte Contre les Grandes Endémies en Afrique de l' Ouest (OCCGE): Mr. Abdou Adamou, Directeur Adjoint, Dr. Philippe Brémont et Dr. Carlos Véra, Projet Bilharziose.

16 Niamey to Tahoua.

17 Visit to the Direction Départementale de la Santé de Tahoua: Dr. Labo, Pharmacien, Directeur par intérim, Dr. Jadi Dambaki, Directeur Adjoint, ESV, Mr. Saibou Ibrah, Coordinateur Maladies diarrhéiques/PMI.

Travel from Tahoua to Tchin Tabaraden.

Visit to the Sous Préfet de l'Arrondissement: Mr. Atouk Mohamadou

Visit to the Dispensary of Tchin Baraden: Dr. Boureima, Médecin Stagiaire, Mr. Ibrahim Ouba Infirmier Chef, Ms Abousseini Salama, Sage Femme.
Preliminary survey in the village of Akarana.

September

18 Surveillance of fever cases at the dispensary of Tchin Tabaraden.

Survey at the village of Akarana.

Return to Tahoua.

19 Tahoua to Maradi Tessaoua.

Visit to the Centre Médical de Tessaoua: Dr. Siddo Daouda, Médecin Chef, Mr. Sale Touji, Sentinel Post Lab technician.

20 Surveillance of fever cases at the dispensary of Kona: Mr Souleiman Didi, Infirmier.

21 Survey of the village of Dagouajé.

Tessaoua to Maradi.

22 Maradi to Gaya.

23 Visit to the Sous Préfet de l'Arrondissement: Mr. Oumarou Diadjé.

Visit to the Centre Médical de Gaya: Dr. Seidou Halgadoubo, Médecin Chef.

Visit to the dispensary of Tanda: Mr. Mounkaila Karimou, Infirmier-Chef.

24 Preliminary survey of the village of Monboye Tounga.

Gaya to Niamey.

25 Data analysis.

26 Data analysis.

September

27	Discussion of results and preparation of final report. Planning of survey in Boukoki.
28	Departure of sociolo[illegible]
	Data analysis.
30	Preliminary survey in Boukoki district of Niamey.
	Entomologic survey in Niamey.
	Surveillance of fever cases in Boukoki MCH clinic.

October

1	Entomologic survey in Niamey.
	Surveillance of fever cases in Boukoki MCH clinic.
2	Data analysis.
	Planning for upcoming studies.
3	Debriefing at MSP.
	Debriefing at USAID/Niamey.
4/5	Translation of final report.
6	Debriefing at VBC/Washington.

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Annex 1. Study Protocols

Parasitologic Studies

Objectives

1. Evaluate the prevalence and intensity of infection in a village/district.

2. Evaluate the seasonal variability of malaria transmission.

Methods

A village or district with 500 to 1,000 inhabitants will be selected. Ideally we would like to obtain a representative sample of the entire population (for example, one household out of three, four or five, depending on the sample size) and to carry out the survey from house to house. This method, however, has two drawbacks:

- It is very slow and inconvenient for a quick cross-sectional survey. It is the best method for a longitudinal study.

- Some population groups are in the village most of the time (for example, the young children), while adults may be out for long periods during the day in the fields or at the market.

The focus of the parasitological studies will be on the age group 0 to 9, which is present in the village most of the time and is of particular interest in malaria epidemiology. The children will be asked to come to a central place in an attempt to reach at least 95 percent of them. In a village of 500, there will be about 175 children and in a village of a 1,000, there will be 350. It would be useful to examine a sample of adults.

Typical population distribution

Age	Village of 500	Village of 1,000
0-1	100	200
2-9	75	150
10-14	50	100
15+	275	550

The parasitologic survey form (p. 51) will include the following information:

- name of person
- name of father
- age
- spleen size
- slide number

Spleen will be examined in children ages 2 to 9 while they are lying down with their legs folded. The spleen size will be recorded following Hackett classification.

Blood will be collected on two slides, each with a thick and a thin smear. The number of the slide will be written with a pencil on the thin smear. The slide will be left to dry in the shade and protected from contact with flies. Dry slides will be stained with Field stain. They will kept in boxes and examined during the trip or later at the central laboratory in Niamey.

A team of three microscopists — two from Niamey and one from the Divisional Directorate of Health — will collect blood and read the slides. They can examine about 50 slides per day.

The species will be determined on the smear. The parasite density will be evaluated by counting the number of parasites per 1,000 white blood cells (WBC) on the thick smear and extrapolating to 1 mm^3 of blood estimating 6000 WBC/mm^3. If the quality of the thick smear does not allow an accurate count, the

FICHE D'ENQUETE PARASITOLOGIQUE

Nom du village

Numero individuel	Nom personnel	Nom du père	Chef de la concession	Age	Sex	Rate	Numero de la lame				Présent avant

density will be evaluated from the thin smear. In that case, the number of parasites should be calculated per 100 red blood cells (RBC) in an area of the smear that has about 200 RBC/field. The percentage of parasitized RBC will be calculated and the number of parasites per mm^3 of blood extrapolated using 4,000,000 RBC per mm^3 as the standard RBC count.

Results will written in the laboratory book and sent to SNIS for data entry.

A random sample of 10 percent of the slides will be re-examined by a technician or a parasitologist who is not aware of the initial results. The second and first readings will be compared. Quality control results will be documented and saved. Results will be presented. The slides will be kept for one year for examination if necessary.

The same survey will be repeated during the rainy and dry seasons. People included in the first survey who are not available for the second or third will be replaced. Information will be collected for the second survey to identify the cohort of people examined twice.

The team carrying out the parasitologic survey will consist of:

- two laboratory technicians from the MCP/Niamey;
- one laboratory technician from the Divisional Directorate of Health;
- one physician from MOPH/Niamey; and
- one or two literate individuals from the village to record the information on the forms.

Results and interpretation

The rate of attendance will be estimated and reasons for low rates documented.

Prevalence of infection will be calculated for the age groups 0 to 1 years, 2 to 9 years, 10 to 14 years, and adults. A comparison of prevalence by sex will be done. Geometric means of parasite densities will also be calculated by age group. The spleen rates and average enlarged spleen will be calculated.

For quality control, the following rates will be calculated: false positives, false negatives, species misidentification and density miscalculation (20 percent off).

Entomologic Surveys

Objectives

1. Determine the species of *Anopheles* present, particularly the species responsible for malaria transmission.

2. Determine the main types of *Anopheles* larval sites.

3. Determine *Anopheles* densities in the main ecological zones.

4. Evaluate the seasonal variations.

5. Evaluate resistance to commonly used insecticides.

6. Evaluate oocyst and sporozoite rates.

Methods

The entomological study will be done in the field and at the laboratory.

In the field

The study will be carried out in the same villages as the parasitologic surveys and in the surrounding areas. It will include:

- collection of immature stages of *Anopheles* in the different types of habitat, with ecological description of the habitat and physico-chemical study of the water (pH and conductivity),

- indoor resting collections, and

- night catches on human bait.

The following information from field collections will be recorded on a form (p. 57) for each habitat:

- o Collection number, date and time.
- o Geographical data: coordinates, altitude, map number, division and name of the village.
- o Temperature of air and water.
- o Stage collected: egg, larva (stage 1, 2, 3, 4), pupa, adult.
- o Type of collection: larval collection, indoor resting collection, night catch on human bait or other bait.
- o Topography.
- o Distance to the nearest building.
- o Height above the soil for adult collection.
- o Meteorological data on the sky and wind at the time of collection.
- o Shade on the larval site.
- o Potential hosts around.
- o Data on the immediate surrounding and modifications done by human activities.
- o Water data: permanent or temporary, movement, salinity, turbidity.
- o Phyto-ecologic data: type and density of vegetation, type and density of algae.
- o A sampling table at the bottom of the form will be used to record the number of *Anopheles* and *Culex* collected for each collection. Larvae of *Anopheles* and *Culex* will be evaluated on 30 larvae per site.

The same survey will be repeated during the dry and rainy seasons.

At the laboratory

The larvae will be bred to obtain all stages and the pupae (which will be preserved in 80% alcohol) or as adults for later identification. A special form will be used for this part of the study.

The adults will be identified. Some of the living adults will be used to evaluate the parasite infection rate. Researchers will dissect and observe the stomach walls for oocysts and the salivary glands for sporozoites.

Other adults will be used for *Anopheles* insecticide resistance tests. A simple test using DDT will be presented to demonstrate the technique to be used later. The leftover adults will be preserved and brought back to a well-equipped laboratory for further testing, in particular for cytochemistry and genetic studies.

The national team will consist of an MOPH entomologist and one or two mosquito collectors.

WALTER REED BIOSYSTEMATICS UNIT, SMITHSONIAN INSTITUTION, WASHINGTON DC 20560

NIGER: 1991 COLLECTORS: VBC/USUHS WRBU ACC NO. 1446

COLLECTION NO. NG	Map Series	Latitude/Longitude N/ V	Date
Time (24 hr.)	Altitude (m)	Water Temp. (°C)	Stages Collected E 1 2 3 4 P A
State	Locality		Dry Bulb (°C): Wet Bulb (°C):

Collection Type
01. Immature
02. Resting-House
03. Animal Shelter
04. Cave
05. Tree Hole
06. Vegetation
07. Other_____
08. Biting
09. Net
10. Light Trap-N.J.
11. Light Trap-SSAM
12. Trap_____
13. Bait Trap-Net
14. Bt Trp-Hagoon
15. Bt Trp_____
16. Swarming
17. Landing
18. At Light
19. Other

Terrain
Mountain
Hill
Valley
Plateau
Plain

Dist. from Homes
_____

Sky
Clear
Part Cloudy
Overcast
Fog
Mist
Light Rain
Heavy Rain

Shade
None
Partial
Heavy

Host
Human
Horse
Pig
Cow
Donkey
Chicken
Other_____

Environment
01. Rain Forest
02. Evergrn Forest
03. Deciduous Frst
04. Cloud Forest
05. Coniferous Frst
06. Scrub
07. Savannah
08. Prairie
09. Swamp-Forest
10. Swamp-Open
11. Salt Marsh
12. Beach
13. Mangrove
14. Orchard-Plntn
15. Cultiv Field
16. Rice Paddy
17. Bamboo Grove
18. Urban
19. Village

Env. Modifiers
Primary
Secondary
Banana
Rubber
Fruit
Palm
Pineapple
Sugarcane
Other

Wind
None
Light
Gusts
Strong

Height Above Ground
_____

Larval Habitat
01. Pond-Lake
02. Ground Pool
03. Swamp
04. Marshy Depressn
05. Stream Margin
06. Stream Pool
07. Rock Pool
08. Seepage-Spring
09. Flood Pool
10. Ditch
11. Pit
12. Well
13. Cistern
14. Artif Contner
15. Tire
16. Tree Hole
17. Stump Hole
18. Bamboo Internode
19. Bamboo Stump
20. Banana Axil
21. HELICONIA Axil
22. BROMELIAD Axil
23. TARO TYPE Axil
24. Pineapple Axil
25. Pitcher Plant
26. Palm Frond
27. Fallen Leaf
28. Coconut Shell
29. Plant_____
30. Salt Marsh
31. Crab Hole
32. Coral
33. FOOT PRINT
34. RUT
35. Rice Field
36. Roof Gutter
37. Bog
38. Other

Dimensions of Site
m X m
_____ m deep

Water Appearn:
Permanent
Temporary

Water Moves:
Stagnant
Slow
Moderate
Fast

Salinity
Fresh
Brackish

Turbidity
Clear
Colored
Turbid
Polluted

Aq. Veg.
Submerged
Floating
Emergent
Sub and Float
Sub and Emerg
Float and Emerg
All types

Quant. Aq. Veg.
None
Scarce
Abundant

Algae
Green
Brown

Algae Density
None
Scarce
Abundant

	An.	Cu.		An.	Cu.		An.	Cu.		An.	Cu.		An.	Cu.
1			7			13			19			25		
2			8			14			20			26		
3			9			15			21			27		
4			10			16			22			28		
5			11			17			23			29		
6			12			18			24			30		

Sociological Studies
(Knowledge, Attitudes and Practices)

Objectives

1. Establish the baseline data for evaluation of health education and behavior modification interventions.

2. Describe the villagers' source of medical care.

3. Establish baseline data on morbidity and mortality from malaria as seen by the villagers.

Methods

A KAP study will be carried out to achieve these objectives. This survey will be done in conjunction with the parasitologic and clinical epidemiology surveys. Questionnaires will be given out in each village and health facility.

The person asking questions should not belong to the health department so as not to bias the answers given. It will be important to explain that there are no good or bad answers and to obtain real answers from the people. Local words should be used to describe malaria, fever, convulsions and mosquitoes.

The questions will be open-ended. Responses will be filled in in French in the order in which the questions are asked. The investigator will go to households to ask the questions.

KAP in the villages

Sex and age seem to be the factors that most influence answers. It will not be necessary to query more than one person from each age group in the same compound. Six persons from each compound will be queried.

Age	Males	Females
Less than 12	0	0
12-24	1	1
25-44	1	1
More than 44	1	1

The KAP questionnaire will consist of the following:

- o demographic data: age, sex, education and occupation;
- o knowledge of symptoms and treatment of malaria;
- o knowledge about convulsions;
- o knowledge of the causes of malaria;
- o knowledge of mosquitoes and their role in malaria; and
- o knowledge of malaria control.

KAP at health facilities

At health facilities, patients with fevers for whom a surveillance form is filled out will also be asked KAP questions. Questionnaires from the village and those from other areas will be analyzed separately.

Interpretation and results

The questionnaires will analyzed manually because of the qualitative nature of the information collected. This information will be coded to allow a statistical analysis of the data.

The KAP questionnaire will be analyzed to describe the KAP regarding malaria in the community and the distribution by ethnic group, age and sex and educational level. A comparison between KAP from each community and its surrounding area will be done to look at possible differences in cultural beliefs.

The KAP questionnaire (pp. 61-64) attempts to determine the knowledge of the population surveyed about malaria (symptoms, treatment, cause and prevention, link between malaria and convulsions, between malaria and miscarriage, role and reproduction of the vector). The information collected will be useful for defining what kind of health education is needed, determining the constraints that cause underutilization of health services, and identifying other sources of health care in the communities.

QUESTIONNAIRE CAP - Village

Date: Enquêteur:

1-Village: 2-Concession numero:

3-Nom: 4-Sexe: 5-Age: 6-Gr.ethnique:

7-Etat civil: 8-Nombre d'épouses:

9-Nombre d'enfants nés: 10-Nombre d'enfants vivants

11-Occupations:

12-Education (no.d'annees): koranique: primaire: secondaire:
alphab.: form. technique: apprenti: autre:

13-Voyages a:

14-Quand avez-vous eu le paludisme la dernière fois?

15-Quels étaient les symptômes quand vous avez eu le paludisme?

16-Combien de jours êtes-vous resté malade? 17-Couché?

18-Qu'est-ce que vous avez fait pour vous soigner? Numeroter dans l'ordre s'il y a plusieurs actions

[] Rien
[] Automedication
produit utilisé: obtenus où: coût:
[] Guérisseur traditionnel
Lequel: type de soins: coût:
[] Secouriste
produit reçu: dosage: coût:
[] Dispensaire
[]Oui: Pourquoi êtes vous allé au dispensaire au lieu de rester au village?
[] Traitement gratuit? Quel produit?
[] Ordonnance donnée? Quel produit?
[] Ordonnance payée complètement? coût:
[] Ordonnance payée partiellement? coût:
[] Ordonnance non payée?
Si ordonnance non payée ou payée partiellement pourquoi?
[]Non, n'a pas été au dispensaire
pourquoi n'êtes vous pas allé au dispensaire?
[] Autres soins
Précisez:

QUESTIONNAIRE CAP - Village page 2

19-A quels signes peut-on savoir qu'une personne (un enfant) fait du paludisme?

20-Si vôtre enfant fait du paludisme, qu'est-ce que vous faites pour le soigner?

21-Que faut-il faire pour faire baisser la fièvre?

22-En quelle saison y-a-t'il le plus de paludisme au village?

23-A vôtre avis qu'est-ce qui nous donne le paludisme?

24-Faites-vous quelque chose pour prévenir le paludisme (pour vous meme et pour vos enfants? Si oui quoi?

25-Arrive-t-il au village que des enfants attrapent des convulsions? A votre avis, qu'est-ce qui cause les convulsions?

26-Que faut-il faire quand un enfant fait des convulsions?

27-Quelles choses peuvent faire avorter une femme enceinte?

28-Est-ce que la femme enceinte peut faire quelquechose pour se protéger contre les avortements? Si oui quoi?

29-Est-ce que le moustique fait du tort aux gens? Si oui, lequel?

30-Savez-vous ou le moustique fait ses petits?

31-Faites-vous quelque chose pour vous proteger contre les moustiques? Si oui, quoi?

32-Qui dans vôtre famille dort sous moustiquaire?

QUESTIONNAIRE CAP - Formation sanitaire

Date: Enquêteur:

1-Village:

3-Nom: 4-Sexe: 5-Age: 6-Gr.ethnique:

7-Etat civil: 8-Nombre d'épouses:

9-Nombre d'enfants nés: 10-Nombre d'enfants vivants

11-Occupations:

12-Education (no.d'annees): koranique: primaire: secondaire:
alphab.: form. technique: apprenti: autre:

13-Voyages a:

18-Qu'est-ce que vous avez fait pour vous soigner? Numeroter dans l'ordre s'il y a plusieurs actions

[] Rien
[] Automedication
produit utilisé: obtenus où: coût:
[] Guérisseur traditionnel
Lequel: type de soins: coût:
[] Secouriste
produit reçu: dosage: coût:
[] Autres soins
Précisez:

18a-Pourquoi êtes vous venu au dispensaire au lieu de rester au village

QUESTIONNAIRE CAP - Formation sanitaire page 4

19-A quels signes peut-on savoir qu'une personne (un enfant) fait du paludisme?

20-Si votre enfant fait du paludisme, qu'est-ce que vous faites pour le soigner?

21-Que faut-il faire pour faire baisser la fièvre.

22-En quelle saison y a-t-il le plus de paludisme au village.

23-A votre avis qu'est-ce qui nous donne le paludisme?

24-Faites-vous quelque chose pour prevenir le paludisme (pour vous meme et pour vos enfants.) Si oui quoi?

25-Arrive-t-il au village que des enfants attrapent des convulsions? A votre avis, qu'est-ce qui cause les convulsions?

26-Que faut-il faire quand un enfant fait des convulsions.

27-Quelles choses peuvent faire avorter une femme enceinte?

28-Est-ce que la femme enceinte peut faire quelquechose pour se proteger contre les avortements? Si oui quoi?

29-Est-ce que le moustique fait du tort aux gens? Si oui, lequel?

30-Savez-vous ou le moustique fait ses petits?

31-Faites-vous quelque chose pour vous proteger contre les moustiques? Si oui, quoi?

32-Qui dans votre famille dort sous moustiquaire?

Clinical Studies

Objectives

The objectives of the clinical studies fall into three categories:

1. Evaluate health care providers:

   1.1 Evaluate the relevance of diagnosis, treatment and preventive actions carried out by health care providers regarding fevers suspected to be malaria.

   1.2 Establish baseline data to evaluate continuing education programs.

2. Develop a fever surveillance system.

   2.1 Evaluate the proportion of fevers in the outpatient population.

   2.2 Set up a surveillance system for evaluating the cause of fevers.

3. Implement a continuing education program for health care providers.

Methods

The population to be studied will be made up of outpatients who come to health facilities and meet the following criteria:

1. complaining of fever, whether it is believed to be malaria or not; or

2. suspecting malaria to be the cause of illness, whether or not he or she has a fever.

This study will be carried out in the health facilities that serve the population surveyed for the parasitologic study. The same questionnaire may also be used in other facilities in the area.

The questionnaire for surveillance of fever cases (pgs. 69-70) will include the following information:

- o data on the health facility;
- o data on the personnel;
- o demographic data on the patient: age, sex, ethnic group, education and occupation;
- o data on the severity of symptoms experienced before attending the health facility (days since time of onset, days activities stopped, days spent in bed);
- o symptoms experienced by the patient;
- o physical examination done by the practitioner, signs of severity (lethargy, coma, convulsions);
- o slide number;
- o diagnosis; and
- o treatment prescribed.

The instructions given to the health care provider will depend on the specific objectives:

1. If the main objective is to evaluate health care providers, the following should be done: provide the questionnaires, explain the selection criteria and ask the physician, nurse or midwife to fill in all the blanks.

2. If the objective is fever surveillance or continuing education of health care providers, tell them that all steps of the medical examination are necessary and that they must take the time to perform a thorough examination.

First, the practitioner will follow the questionnaire as a guide for a patient interview. Then the clinical examination (examining the main organ systems to look for a specific etiology or for signs of severity, measuring the patient's temperature, examining the spleen, collecting blood) will take place. The blood will be collected by

finger prick following the same procedure used in the parasitologic survey. Once the examination has been completed, the health care provider will fill in the examination results, think about the diagnosis and write it down. Then he or she will decide on the appropriate treatment, write it down, and give the patient his or her recommendations.

The questionnaire will be filled out by a physician, nurse or midwife. The blood will be collected by a laboratory technician.

The questionnaires will be evaluated before the information is entered into a computer database. This following will be evaluated:

1. severity of symptoms before consultation;
2. diagnosis of malaria, correct or not;
3. diagnosis of cerebral malaria, correct or not;
4. other diagnosis, correct or not;
5. selection of antimalarials, correct or not;
6. dosage, correct or not.

The data will be entered on personal computers using a database program for data entry (DBase 3+) and analyzed statistically with EpiInfo. If necessary, more elaborate statistical programs will be used. The quality of the information will be evaluated before statistical analysis begins.

The same survey will be carried during the dry and the rainy seasons.

Results and interpretations

The results will include with the following:

- Distribution of the population by age and sex.
- The origin of outpatient populations not coming from the villages. Who are they?
- Severity of symptoms before consultation.
- Description of symptoms. Comparison between infected and noninfected to determine ways to improve malaria diagnosis.
- A calculation of the predictive value of each symptom and combination of symptoms.

- Description of physical signs.
- Description of spleen enlargement and analysis of its association with infection.
- Predictive value of fever, enlarged spleen.
- Predictive value of health care provider's diagnosis.
- Description of other diagnoses. Comparison according to infection status.
- Prevalence of previous treatment.
- Description of treatment given. Over- or undertreatment. Poor selection of drug.

SURVEILLANCE DES CAS FEBRILES

Localité [ ] Fiche Numero [ ]

Formulaire rempli par [ ] Date: __ __/19__

Titre: 1-Médecin 2-Infirmier/ère 3-Sage Femme 4-Autre:

Type de Formation: 1-Disp rural 2-Disp quartier 3-Ctre PMI
4-Poste médical 5-Centre médical 6-Hopital

Nom du malade [ ] Age du malade en années revolues

Sexe 1-M 2-F [ ] Enceinte (F) 0-Non 1-Oui [ ] Sait lire 0-Non 1-Oui

Si enceinte, Prophylaxie palu 0-Non 1-Oui [ ] Nb comprimés/semaine

Profession habituelle: 1-Agriculteur 2-Eleveur 3-Pêcheur 4-Artisan
5-Employé 6-Fonctionnaire 7-Commerçant 8-Elève 9-Ménagere
10-Sans emploi 11-Autre:

Ethnie: 1-Haoussa 2-Dierma/Songhai/Dandi 3-Touareg/Bella 4-Peuli
5-Kanouri 6-Toubou 7-Gourmantché 8-Arabe 9-Autre:

Origine: 1-Evacué d'ailleurs 2-présenté lui meme ou accompagné
3-Referre par agent de santé communautaire

Provenance: 1-Même village 2-Village de région 3-Nomade 4-Autre

Temps ecoulé depuis début de maladie (jour) [ ] Activités interrompues (jours), 0 si non [ ] Journées passée couché, 0 si n

SYMPTOMES: 0-Non 1-Oui depuis debut de maladie

Fièvre [ ]	Maux de tete [ ]	Frissons [ ]
Vomissements [ ]	Diarrhée [ ]	Sueurs [ ]
Brulure dans urines [ ]	Douleurs articulations [ ]	Difficulté à respirer [ ]
Somnolence [ ]	Convulsions [ ]	Coma [ ]
Toux 0-Non 1-Moins de 15 jrs 2-Plus de 15 jrs		

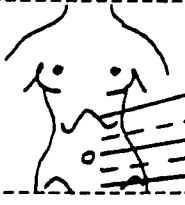
EXAMEN CLINIQUE 0-Non 1-Oui

Convulsions [ ]	Raideur nuque [ ]	Difficulté a respirer [ ]
Conscience 0-Alerte 1-Léthargique 2-Coma		
0-Normal 1-Anormal	Pharynx [ ]	Auscultation [ ]

Temperature 0-Non prise 1-Axillaire 2-Rectale 3-Autre [ ] Temperature en degres -

Peau: 0-Normale 1-Eruption 2-Impetigo 3-Autre

Rate:



0-Non palpable
1-Palpable sous cotes
2-Intermediaire
3-Nombril
4-Au dessous du nombril
5-Fosse iliaque

TOURNEZ LA PAGE >>>>>>>>>>>>>>>

VOTRE DIAGNOSTIC:
Paludisme 0-Non 1-Oui [ ] Accès pernicieux 0-Non 1-Oui [ ]

AUTRE DIAGNOSTIC: N'indiquer que le diagnostic le plus important
0-Aucun 1-Maladie respiratoire 2-Diarrhée 3-Maladie de peau
4-Maladie urinaire 5-Rougeole 6-Meningite 7-Autre:preciser

PARASITO: Examen à faire seulement si possible et indiqué
Frottis/Goutte epaisse 0-Non fait 1-Fait
Les résultats seront entrés après examen de labo
Numero de la lame [ ]

TRAITEMENT ANTERIEUR
Quinimax 0-Non 1-IM 2-IV [ ]
Autre: [ ]
Chloroquine: Nombre de comprimés [ ]
Flavoquine : Nombre de comprimés [ ]
Traditionnel 0-Non 1-Oui [ ]

TRAITEMENT PRESCRIT: Indiquer la dose journalière en mg

	Jour 1	Jour 2	Jour 3	Jour 4	Jour 5	Jour 6	Jour 7
Chloroquine							
Quinimax IM							
Quinimax IV							
Autre							

Antipyrétique 0-Non 1-Oui [ ] Traitement reduisant fièvre 0-Non 1-Oui [ ]

PRISE EN CHARGE 1-Traitement administré sur place 2-Ordonnance donnée
3-Traitement administré et ordonnance 4-Hospitalisé sur place
5-Evacué sur centre médical 6-Evacué vers l'hôpital

Conseils préventifs donnés 0-Non 1-Oui

COMMENTAIRES

RESERVE
[ ]-1 [ ]-2 [ ]-3 [ ]-4 [ ]-5 [ ]-6
[ ]-7 [ ]-8 [ ]-9 [ ]-10 [ ]-11 [ ]-12

Annex 2. Malaria Studies Done in Niger

Studies of malaria in Niger have dealt with the parasitologic, entomologic and clinical aspects of malaria.

1. Malariometric surveys

1.1. Malaria surveys done in the 1960s

OCCGE did a series of malaria surveys during the 1960s. They are summarized on the following pages (OCCGE 1964).

Area (3)	Date	Age	Spleen Pos/Ex.	Prev %	Blood Pos/Ex.	Prev %	Parasite formula*
Sudanian Zone <15km from Niger River (1)	Mar 61	0-1	19/71	26.7	125/188	66.4	Pf 97.6%
		1-2	81/141	57.4	118/152	77.6	Pm 9.2%
		2-9	451/861	52.3	616/864	71.3	Mix 6.8%
		10+	112/380	29.4	215/384	56.0	
Sudanian Zone 15 to 80 km from Niger river (2)	Mar 61	0-1	15/199	7.5	62/197	31.5	Pf 97.3%
		1-2	13/113	11.5	43/111	38.7	Pm 5.8%
		2-9	326/983	33.1	438/984	44.5	Mix 3.1%
		10+	88/343	25.6	120/342	35.1	
Agadez Division	Oct 62	0-1	3/111	2.7	7/141	6.3	Pf 100%
		1-2	5/72	6.9	4/72	5.5	Pm 0.0%
		2-9	3/508	0.6	32/508	6.3	Mix 0.0%
		10+	1/206	0.5	6/206	2.9	

(1) Villages of Sakouara, Sausane, Farie, Diakindi, Dotiemana, Tamou, Bossebangou, Lamonde Tori.
(2) Villages of Dabakofana, Doukousaro, Handalaye, Dantiambou, Ouallam.

* This relates to all age groups combined.

Area (3)	Date	Age	Spleen Pos/Ex.	Prev %	Blood Pos/Ex.	Prev %	Parasite formula*
Tahoua Division	Oct 62	0-1	53/141	36.0	80/147	54.4	Pf 96.4%
		1-2	47/88	53.4	54/88	61.4	Mix 7.8%
		2-9	598/1205	49.6	775/1205	64.3	Mix 4.2%
		10+	58/370	15.7	174/370	47.0	
	May 63	0-1	30/161	18.6	45/161	27.9	Pf 91.1%
		1-2	76/265	28.7	85/265	32.1	Pm 12.1%
		2-9	563/1733	32.4	558/1733	32.1	Mix 3.2%
		10+	52/640	8.1	185/640	28.9	
Zinder Division	Oct 62	0-1	83/263	31.5	143/263	54.4	Pf 97.2%
		2-9	632/1099	57.5	641/1099	58.3	Mix 5.0%
		10+	93/473	19.7	188/473	39.7	
	May 63	0-1	70/433	16.0	165/433	38.1	Pf 11.3%
		1-2	70/258	27.1	133/259	51.3	Pm 11.3%
		2-9	467/1338	34.9	583/1338	43.5	Mix 5.9%
		10+	43/378	11.4	107/378	28.3	

(1) Villages of Sakouara, Sausane, Farie, Diakindi, Dotiemana, Tamou, Bossebangou, Lamonde Tori.
(2) Villages of Dabakofana, Doukousaro, Handalaye, Dantiambou, Ouallam.

* This relates to all age groups combined.

1.2. Malariometric survey in the Sahelo-Saharian zone: Tchin Tabaraden

A survey was carried out in the Tchin Tabaraden Subdivision at Tchin Tabaraden and Abalak in October 1985 and June 1986. Annual rainfall is 140 mm in Tchin Tabaraden and 242 mm at Abalak. This subdivision lies at the northern edge of the Sahelian zone, with very sparse vegetation. As soon as the rainy season starts, ponds appear. The smaller ponds are temporary while the larger ones last for a few months after the end of the rainy season. Nomadic populations (Touaregs and Fulani) come closer to the bodies of water during the rainy season. Touareg children who had spent the entire year in the area were surveyed. The following hamlets were visited: Akarana, Tchin Tesawatan, In Waghsan, Ezaman, Azakwa, In Tamazouk, Gazetra and In Ligart.

Malaria Survey in Tchin Tabaraden

	Spleen Exam		Prev.		AES*	
Age	Oct 85	Jul 86	Oct 85	Jul 86	Oct 85	Jul 85
1 - 2 yrs	26	18	15.4%	16.6%	2.00	2.00
2 - 9 yrs	165	165	18.8%	9.7%	1.68	1.25

* Average Enlarged Spleen

	Parasit. exam		Prev.		Parasite formula*	
Age	Oct 85	Jul 86	Oct 85	Jul 86	Oct 85	Jul 86
1 - 2 yrs	26	19	38.5%	0.0%	Pf 96.4%	60.0%
2 - 9 yrs	161	167	48.4%	3.0%	Po 3.3%	40.0%

* Pf = *P. falciparum*
Po = *P. ovale*

The malaria prevalence varies widely, from 48 percent during the rainy season to 3 percent during the dry season. Malaria endemicity goes from meso- to hypoendemicity.

Recent Fever/Chloroquine Intake

Oct 85	Jul 86	Oct 85	Jul 86
184/201	82/199	14/201	7/199
92%	41%	7%	3.5%

1.3. Malariometric survey along the Trans-Saharian Highway

A malaria survey was done by Robert (1988) during the entomologic survey conducted along the Trans-Saharian Highway in October 1988. Out of 865 blood samples taken, the following results were obtained:

Parasite Rates by Village

Village	Examined	Positive	Prev.
Tiguidan Dessoum	252	51	20.2%
Timia	250	11	4.4%
Iférouane	250	1	0.4%
Assamaka	113	7	6.2%

1.4. Malaria survey in the Sudano-Sahelian zone: epidemiologic variety in the Tillaberi Division

A malariometric survey was conducted in the Tillaberi Division in December 1982 (Baudon 1986), two months after the end of the rainy season. Fourteen villages were surveyed, some on the river bank or on an island, others at distances ranging from 3 to 50 km from the river. More than 14,000 people lived in these villages. The annual rainfall was about 500 mm per year.

Malaria Survey In Tillaberi

Age	Spleen exam	Prev	AES	Prev	Density (parasite/ cmm^3)	Parasite formula*
0 - 1 yrs	79	2.3%	1.70	18.9%	23,000	P.f. 30%
1 - 2 yrs	31	4.8%	1.70	37.5%	13,300	P.m. 2%
2 - 9 yrs	322	22.8%	2.10	33.5%	6,800	P.f. + P.m. 62%
10 -14 yrs	72	11.8%	1.57			

* This relates to all age groups combined.

Malaria was mesoendemic in the area at this time of the year. There were wide variations in malaria transmission between villages. *Anopheles* densities were much higher in the villages located close to the river or close to permanent bodies of water. The villages that had only wells or muddy ponds had much lower malaria transmission.

Results by Village, Malaria Survey in Tillaberi

Villages	SR	PR	Situation
Fountougou	25.8	22.6	Close to the river
Yassane	13.3	26.6	
Dessa	23.3	36.7	
Doulsou	10.0	23.2	
AG Koyre	16.7	30.0	
Toumkous	16.7	46.7	
Molia	13.3	26.6	East far from the river
Guegourou	10.0	20.0	
Famale	23.3	26.7	
Gaya	37.5	50.0	
Kolman	18.8	19.0	West far from the river
Weze Bangou	21.9	43.8	
Teguey	56.3	37.5	
Takatala	29.0	51.6	

1.5. Rice culture area close to Niamey

A survey was carried out in eight villages close to Niamey, in the Libore area, Subdivision of Kollo (Gado 1982). The villages of Banigoungou, Goungou, Mallalay, Tonkobangou and Tiendifarou were in the western part of the area between the road and the river. The villages of Sekire Zarma, Koara Koukou and Libore Zarma were inland, lying between 5 and 8 km from the river. The children examined were 1 to 5 years old.

Malaria Survey in the Libore Area, Children 1 - 4

Village	Pos/Ex.	SR	Blood Pos/Ex.	PR
Banigoungou	13/84	15.5%	15/84	17.8%
Goungou	1/23	4.3%	5/23	27.7%
Koara Koukou	1/29	3.4%	2/29	6.9%
Libore Zarma	13/55	23.6%	15/55	27.3%
Mallalay	4/13	30.7%	10/14	71.4%
Sekire Zarma	8/34	23.5%	6/34	17.6%
Tiendifarou	3/49	6.1%	14/49	28.6%
Tokobangou	7/46	15.2%	5/46	10.9%
Total	50/333	15.0%	72/334	21.6%

Out of 334 children ages 1 to 5, 72 were infected, a parasite rate of 21.8 percent with a parasite formula Pf 84.7 percent, Pm 12.5 percent. The spleen rate was 15.0 percent.

1.6. Comparison between villages with different access to antimalarials in the Sudano-sahelian zone: Dosso Division

Haegeman (1989) did a survey in the Dosso Division to compare the malaria situation between two villages with different access to antimalarials. Loutou Kwara is 17 km from a dispensary and does not have a VHW. The village of Kikoudou Kwara has a VHW. Each village has a population of 300 and receives an annual rainfall of 500 to 600 mm. The villages have no permanent bodies of water.

Malaria Survey in the Dosso Division
Loutou Kwara: no antimalarials

Age	Exam	SR	AES	PR	Parasite Formula*
0-2 yrs	15	46%	1.57	93%	Pf 100% Pm 2.7%
2-9 yrs	68	55%	1.47	85%	Pf 100% Pm 2.7%

Kikoudou Kwara: with antimalarials

Age	Exam	SR	AES	PR	Parasite formula*
0-2 yrs	15	20%	1.0	46%	Pf 100% Pm 2.3%
2-9 yrs	75	40%	1.33	48%	Pf 100% Pm 2.3%

* This relates to all age groups combined.

Malaria is holoendemic in the village of Loutou Kwara. In Kikoudou Kwara, where antimalarials are available, the malaria situation is much better.

1.7. Survey in the western part of the Sudano-sahelian zone

In October 1985, while carrying out an immunologic survey, Cenac (1988) reported a parasite rate (PR) of 58.3 percent in the village of Belleyara in western Niger.

1.8. Difference between urban and rural areas: Maradi and Tarna

A study was conducted in the town of Maradi and the village of Tarna, both in the Maradi Division in the Sahelian zone, during February /March 1985 and July/August 1985 (Le Bras 1986). The mean annual rainfall ranges from 500 to 600 mm in this area with a single rainy season lasting an average of 140 days per year.

A systematic survey of 1 of 15 compounds was done in the town of Maradi. A town of 66,000, Maradi is the capital city of the Maradi Division. The town is located on a plateau crossed by an intermittent stream. It is a mixture of modern districts with concrete houses, districts with mud brick and thatch houses, and peripheral districts with temporary thatch houses where rural immigrants dwell.

Malariometric survey in Maradi

Age	Spleen Exam	Spleen Rate Feb 85	Spleen Rate Aug 85	AES Feb 85	AES Aug 85
2-9 yrs	900	0.7%	2.6%	1.57	1.42

Parasite rate

Age	Exam Parasit.	Feb 85	Aug 85	Parasite formula, *P. falciparum*
0 - 2 yrs	15	7.7%	0.0%	100%
2 - 9 yrs	96	1.0%	3.1%	100%
> 9 yrs	71	0.0%	0.0%	

The village of Tarna is located some 10 km from Maradi. It has a population of 1,500 living on millet culture. Water comes from temporary ponds or wells. The people of Tarna attend the Maradi health facilities.

Malariometric Survey in Tarna

Age	Spleen Exam	Spleen Rates Feb 85	Spleen Rates Aug 85	AES Feb 85	AES Aug 85
2 - 9 yrs	121	38.0%	42.0%	1.78	1.64

AES = Average Enlarged Spleen

Age	Exam Parasit.	Parasite rate Feb 85	Parasite rate Aug 85	Parasite formula, *P. falciparum*
0 - 2 yrs	32	6.2%	3.1%	100%
2 - 9 yrs	121	11.6%	29.7%	100%
>9 yrs	47	3.3%	6.6%	100%

The spleen rate, average enlarged spleen and parasite rates were much lower in Maradi than in Tarna. Seasonal variations are important in the village but not in the town. Malaria is mesoendemic in Tarna and hypoendemic in Maradi.

2. Entomologic surveys

2.1. WHO List of *Anopheles*, 1968

A list of *Anopheles* was prepared by WHO in 1968. It showed that there were five species in Niger:

- *An. gambiae* in the major parts of the country;
- *An. funestus* associated with rice cultures (Gillies & Coetzee 1987) along the Niger river;
- *An. pharoensis* and *An. rufipes* in the western and central areas; and
- *An. dthali* in the northern desert areas.

2.2. *Anopheles* captured along the trans-Saharian highway

The study done by Smith (1981) from August to September 1979 showed six species of *Anopheles* in Niger ranging from the 13° and the 19° parallel North.

An. dthali and *An. hispaniola* (species commonly found in the Hoggar mountains) were found in the desert area. *An. arabiensis*, which is part of the *An. gambiae* complex, was collected from Niamey to Agadez. The other three species, *An. pharoensis*, *An. squamosus* and *An. gambiae s.l.*, ranged from Aderbissinat to the southern part of Niger and became more and more abundant as the bioclimatic conditions improved.

Species	Latitudes
An. gambiae s.l.	13° -17° N
An. arabiensis	13° 30' -17° N
An. pharoensis	13° 40' -15° N
An. squamosus	13° 40' -15° 30' N
An. dthali	17° 30' -19° N
An. hispaniola	19° N

2.3. *Anopheles* captured in the Tillaberi area

The epidemiologic survey carried out in December 1982 (Baudon 1986) in the Tillaberi area found four species of *Anopheles*: *An. gambiae* (complex), *An. pharoensis*, *An. rufipes* and *An. nili*.

An. gambiae represented 98.9 percent of the 1,600 *Anopheles* caught in the morning inside the houses. There were only a few *An. pharoensis*, *An. nili* and *An. rufipes*. The sporozoite index was 0.7 percent. Ninety-eight percent of the 1,600 *Anopheles* caught at night on human bait were *An. gambiae*. On the average, a person was bitten 66.2 times per night and at least one of those bites was infective because the sporozoite rate was 1.4 percent. The transmission season lasted up to two months after the end of the rainy season. Villages were divided into three categories:

- high *Anopheles* density: more than 10 *Anopheles*/house,
- medium *Anopheles* density: from five to nine *Anopheles* per house, or
- low *Anopheles* density: less than five *Anopheles*/house

2.4. *Anopheles* caught along the Trans-Saharian Highway in 1988

A study done along the Trans-Saharian Highway in October 1988 (Robert 1988) found six species of *Anopheles*:

- *An. gambiae* (complex), whose northern limit is at least the 18th parallel;
- *An. pharoensis*, *An. rufipes* and *An. coustani*, collected in Kao;
- *An. multicolor*, captured in Tabelot and Timia; and
- *An. dthali*, collected in the northern part of Niger (Elméki, Timia and Iférouane).

2.5. Conclusions

The literature on entomological studies in Niger reports 11 species of *Anopheles*. Our entomological survey added a twelfth species, *An. ziemanni*, in the Gaya region.

Species	Latitudes
An. ziemanni	12° N
An. funestus	12° - 14°30' N
An. gambiae s.l.	13° - 18° N
An. arabiensis	13°30' - 17° N
An. pharoensis	13°40'- 15°30' N
An. squamosus	13°40' - 15° N
An. rufipes	14° - 15°30' N
An. nili	14° N
An. coustani	15°30' N
An. dthali	17°40' - 18° N
An. dthali	17°30' - 19° N
An. hispaniola	19° N

3. Clinical epidemiology studies

3.1. Malaria as a cause of malaria in Galmi

A case control study was carried out in Galmi from April 1987 to March 1988 (Moret 1989). Galmi, a small town of 10,000 people in the Sudano-Sahelian zone, received 311 mm of rainfall during that year. The majority of Galmi's inhabitants are farmers living on millet crops. The study included 577 cases (fever >37.5°C) and 577 controls (no fever) from the outpatient department.

The parasite rate varied according to the season. It was high during and just after the rainy season and low during the rest of the dry season.

The overall difference between rates of cases and controls was small: the PR was 31.2 percent for the cases and 26.0 percent for the controls, the SR was 14.9 percent for the cases and 13.2 percent for the controls. A more detailed analysis showed the parameters associated with malaria infection. The most important was the season: during the season of low transmission there was no association between fever and malaria infection.

Parasite and Spleen Rates According to Season

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Rainfall	3	27	6	80	172	24	0	0	0	0	0	0	312
SR	19	13	10	11	14	16	26	27	22	21	10	11	15
PR	12	4	3	10	26	52	68	60	64	26	21	10	31
Transmission	--	--	--	--	++	++	++	++	++	++	+	--	

Parasite formula: *P. falciparum* 98.2%, *P. malariae* 7.4%, *P. ovale* 0.6%

Data analysis also revealed a large difference in the distribution of the causes of fever according to the season. Fevers were classified as:

- o ARI = Acute Respiratory Infection
- o FSO = Fever of Specific Origin (skin infections, gastrointestinal infections, meningitis)
- o FUO = Fever of Unknown Origin, with no specific signs; it is in this category that malaria cases were found.

During the season of low transmission, almost 75 percent of fevers were associated with ARI. During the high transmission season, on the other hand, half of all fevers above 38°C and 90 percent of fevers of 39°C were FUO (presumed malaria).

Parasite Rate According to Season, Diagnosis and Temperature

Diagnosis	Low transmission	High transmission	
		Temp >38°C	Temp >39° C
ARI	22%	46%	50%
FSO	10%	20%	33%
FUO	16%	87%	94%
Controls	12%	No fever	

The duration of fever was also an important consideration. Malaria infection was the most common among the illnesses of shorter duration.

Association Between Fever Duration and Malaria Infection for the FUO During the High Transmission Season

	Less than 3 days	More than 3 days
PR	93%	64%
HDP	78%	41%

The study of the Odds Ratios (OR) between fever and the following variables — parasitemia, HDP and splenomegaly — showed the following:

	Parameter	OR	Confidence interval
Temperature >39°	Parasitemia	21	4-247
	HDP	12	5-50
	Splenomegaly	3	1-11
Temperature >38°	Parasitemia	9	4-25
	HDP	10	5-25
	Splenomegaly	2.3	1-5

In summary:

- o During the low transmission season, malaria is uncommon and there are no clinical signs to accurately predict infection.

- During the high transmission season, ninety three percent of the FUOs lasting less than three days were due to malaria, 78 percent of the FUOs for less than three days had a high density of parasitemia, and at least 94 percent of the FUOs >39°C were infected with malaria.

3.2. Malaria as a cause of fever of children in Niamey

Two groups of children attending the MCH department in Niamey were studied (Ari Chebou 1989). The children with a fever >38°C and without signs of cerebral malaria were examined. The majority came from Niamey and a few were from rural areas.

The season was one of the most important factors in the etiology of fevers. Out of 277 children examined during the dry season (from May to July), 79 percent were diagnosed as malaria cases while only 5 percent were confirmed by parasitological examination. During the rainy season (from September to October), 299 children were examined, 99 percent were diagnosed as malaria cases, and 62 percent were confirmed by parasitologic examination. The parasite formula was Pf 99.5%, Pm 3.5%, Po 3.5%. The parasite densities observed during the high transmission season were much higher: 93,000 infected RBC/mm^3 versus 50,000. Many mothers had given antimalarials to their children before coming to the health facility. (40 to 55% according to the season).

The spleen rate did not vary much by season. Overall there were 77 enlarged spleens out of 577 children examined, an SR of 17 percent during the high transmission season and 13 percent during the low transmission season.

The effects of self medication on infection were difficult to explain. The proportion of HDP was similar among children whether they were self-medicated adequately or not.

Children self-medicated	Number	DP-1	DP-2	DP-3
Sufficient	54	11%	17%	73%
Insufficient	38	16%	23%	60%

DP-1 = Density of parasite < 1,000/mm3
DP-2 = Density of parasite 1,000 to 10,000/mm3
DP-3 = Density of parasite > 10,000/mm3

4. Analysis of malaria surveillance using the national system of health information

The National Health Information System (SNIS) is a health data collection system that includes presumptive malaria cases reported by health facilities.

4.1 Total number of presumptive malaria cases notified

Health facilities are not easily accessible to the whole population: 20 percent live less than five km from a health facility, 35 percent live from five to 15 km and 45 percent live farther than 15 km away. Only a small proportion of the population goes to a health facility to seek treatment for a malaria attack.

The total number of presumed malaria cases (PMC) was 683,332 in 1990, or 8.8 percent of the total population of Niger. From 1981 to 1989, the number of PMC ranged from 400,000 to 600,000 per year, with a mean of 370,000 per year. During this decade, the number of health facilities increased, which must have had some influence on the total number of PMCs.

4.2 Number of PMC per year

Even though malaria surveys carried out in Niger often find that the proportion of the population carrying malaria parasites is greater than fifty percent, the total number of presumed malaria cases is equal to 8.8 percent of the total population.

Year	PMC
1981	393,272
1982	390,819
1983	354,249
1984	427,818
1985	617,168
1986	617,655
1987	618,583
1988	485,435
1989	502,844
Mean	367,320

4.3 Proportion of PMC that are real malaria cases

It is difficult to estimate the proportion of PMC that are real malaria cases. This proportion varies depending on numerous variables:

- Seasonal variations are probably the most important variable. During the high transmission season (rainy season), malaria becomes the major cause of fevers, particularly of fevers of unknown origin (FUO) without any specific signs.

- Epidemics of specific diseases: during epidemics of diseases with fevers with specific signs (respiratory infections, for example) it is easy for nurses to differentiate other kinds of fever from malaria. Otherwise most fevers may end up being classified as malaria.

- Clinical acumen of nurses: many nurses do not bother examining the patient or taking his or her temperature. Anyone complaining of fever is automatically treated for malaria with no questions asked.

- Even after thorough clinical examination, it is difficult to accurately predict malaria among FUOs if no parasitological exam is made. Parasitological examinations, however, are rarely made.

The study done in Niamey on 576 children showed that 5 percent of fever cases were due to malaria during the dry season while 60 percent of cases during the rainy season were due to malaria (Olivar 1990). Similarly, Moret (1989) in Gilma showed that 15 percent of the FUO were due to malaria during the dry season and 90 percent during the rainy season.

To estimate the real proportion of malaria cases among PMCs, we used the estimates of 10 percent of FUOs during the low transmission season and 75 percent during the high transmission season. The following estimates were made using the mean annual number of PMCs from 1981 to 1989. If the malaria cases are estimated at 174,500 out of a mean PMC of 367,320, about 47 percent of the PMC would be due to malaria. One may estimate that each year, 2 percent of the total population of Niger is treated for malaria at a health facility. What is the proportion of the population that gets malaria each year? One hundred percent may not be an exaggeration.

Estimation of the Real Number of Malaria Cases in Niger Each Year

Month	Rainfall in mm mean 1981-1989	PMC mean 1981-1989	Cases of malaria estimate
January	0.0	20,280	2,000
February	0.0	20,850	2,100
March	4.4	20,265	2,000
April	2.7	17,800	1,800
May	43.6	15,700	1,600
June	59.9	16,130	1,600
July	130.2	21,460	2,100
August	124.2	40,750	30,600
September	87.0	70,420	52,800
October	5.7	65,700	49,300
November	0.0	35,100	26,300
December	0.0	22,850	2,300
Total	457.18	367,320	174,500

4.4 Distribution of cases by age

The PMC rate varies according to age group. It increases during childhood, reaching a maximum of 21.8 percent among teenagers, then decreases to 6.6 percent among adults. If this reflected only malaria cases, one would expect wider differences between infants and young children and between children and adults. It is likely that other fevers are included in the PMC rate for infants.

Distribution of PMC by age group

Age group	0-1	1-4	5-14	15+
PMC per 1,000	60	118	218	66

4.5 Geographical distribution of PMC

The geographical distribution of PMC rates by age group and geographical area are presented in the table below. They do not follow the known distribution pattern of malaria in Niger.

Malaria prevalence is low in the Saharian region. The Agadez Division in the Saharian region, however, has a rate of 150/ 1,000 while the Tillaberi and Dosso Divisions, which are located in the Sahelian region, have lower rates (62 and 98 respectively). In the Tahoua Division, the subdivision with the highest PMC rates is Tchin Tabaraden (148/1000) at the Sahelo-Saharian border while the southern subdivisions such as Birni Konni have much lower rates (97/1000).

The prevalence of malaria is lower in urban areas, but urban areas show PMC rates much higher than their neighboring areas. Niamey's PMC rate of 207/1000 is one of the highest in the country. In the Maradi Division, the subdivision of Maradi's PMC rate of 238/1000 is higher than those of all surrounding subdivisions.

These results are not surprising considering the low proportion of the entire population that seeks treatment for malaria at a health facility. Other factors such as accessibility of health facilities and use of alternative sources of medical care have a greater influence on PMC rates than malaria prevalence. Therefore, it makes sense that urban areas, where the population makes more use of the health facility, would have higher PMC rates.

It would be useful to analyze this geographical distribution in more detail. The proportion of the population living within 5 km of a health facility would be an interesting variable to consider. The analysis could also be restricted to rainy season data because these provide a more accurate picture of malaria endemicity than data for the entire year.

Table 1. Population in 1990

ID Cat Administrative Division	Total	PMC in 1990 0-1	1-4	5-14	15+
11 Su Agadez	137,151	26,607	21,396	13,715	75,433
12 Su Sulit	82,791	16,061	12,915	8,279	45,535
13 Su Bilma	8,675	1,683	1,353	868	4,771
1 Di AGADEZ	228,617	44,352	35,664	22,862	125,739
21 Su Diffa	80,298	15,578	12,526	8,030	44,164
22 Su Maine Soroa	83,577	16,214	13,038	8,358	45,967
23 Su Nguimi	27,405	5,317	4,275	2,741	15,073
2 Di DIFFA	191,280	37,108	29,840	19,128	105,204
31 Su Birni Ngaoure	221,831	43,035	34,606	22,183	122,007
32 Su Dogon-Doutchi	338,739	65,714	52,842	33,873	186,302
33 Su Dosso	267,583	51,911	41,743	26,758	147,171
34 Su Gaya	177,543	34,443	27,697	17,754	97,649
35 Su Loga	95,121	18,453	14,839	9,512	52,317
3 Di DOSSO	1,100,808	213,557	171,726	110,081	605,444

Su = subdivision or arrondissement
Di = division or département

Table 1. Population in 1990 (cont.)

ID Cat Administrative Division	PMC in 1990				
	Total	0-1	1-4	5-14	15+
41 Su Aguie	184,747	35,841	28,821	18,475	101,611
42 Su Dakoro	276,879	53,715	43,193	27,688	152,283
43 Su Guidan Roumji	228,603	44,349	35,662	22,860	125,732
44 Su Madarounfa	207,030	40,164	32,297	20,703	113,867
45 Su Maradi	131,536	25,518	20,520	13,154	72,345
46 Su Mayahi	241,973	46,943	37,748	24,197	133,085
47 Su Tessaoua	230,669	44,750	35,984	23,067	126,868
4 Di MARADI	1,501,437	291,279	234,224	150,144	825,790
51 Su Fillingue	304,057	58,987	47,433	30,406	167,231
52 Su Kollo	259,237	50,292	40,441	25,924	142,580
53 Su Ouallam	201,351	39,062	31,411	20,135	110,743
54 Su Say	180,676	35,051	28,18	18,068	99,372
55 Su Tera	315,770	61,259	49,260	31,577	173,674
56 Su Tillaberi	161,436	31,319	25,184	16,144	88,790
5 Di TILLABERI	1,422,527	275,970	221,914	142,253	782,390
61 Su Birni Konni	273,019	52,966	42,591	27,302	150,160
62 Su Bouza	189,841	36,829	29,615	18,984	104,413
63 Su Illela	185,209	35,931	28,893	18,521	101,865
64 Su Keita	166,760	32,351	26,015	16,676	91,718

Table 1. Population in 1990 (cont.)

ID Cat Administrative Division	Total	PMC in 1990			
		0-1	1-4	5-14	15+
65 Su Madaoua	230,222	44,663	35,915	23,022	126,622
66 Su Tahoua	267,900	51,973	41,792	26,790	147,345
67 Su Tchin Tabaraden	80,888	15,692	12,619	8,089	44,488
6 Di TAHOUA	1,393,839	270,405	217,439	139,384	766,611
71 Su Goure	173,303	33,621	27,035	17,330	95,317
72 Su Magaria	373,884	72,533	58,326	37,388	205,636
73 Su Matameye	176,370	34,216	27,514	17,637	97,004
74 Su Mirriah	445,669	86,460	69,524	44,567	245,118
75 Su Tanout	201,848	39,159	31,488	20,185	111,016
76 Su Zinder	140,154	27,190	21,864	14,015	77,085
7 Di ZINDER	1,511,228	293,178	235,752	151,123	831,175
81 NIAMEY	434,673	84,327	67,809	43,467	239,070
TOTAL	7,784,409	1,510,175	1,214,368	778,441	4,281,425

Table 2. Number of PMCs in 1990

ID Cat Administrative Division	PMC rates per 1,000 Ages (years)				
	0-1	1-4	5-14	15+	Total
11 Su Agadez	3,392	4,972	5,526	12,563	26,453
12 Su Sulit	1,488	1,626	1,387	2,060	6,561
13 Su Bilma	149	243	386	580	1,358
1 Di AGADEZ	5,029	6,841	7,299	15,203	34,372
21 Su Diffa	805	1,792	2,637	6,054	11,288
22 Su Maine Soroa	330	719	1,193	3,167	5,409
23 Su Nguimi	246	479	525	2,053	3,303
2 Di DIFFA	1,381	2,990	4,355	11,274	20,000
31 Su Birni Ngaoure	2,873	4,894	5,926	10,990	24,683
32 Su Dogon-Doutchi	7,778	5,209	8,550	9,873	31,410

Table 2. Number of PMCs in 1990 (cont.)

ID Cat Administrative Division	PMC rates per 1,000 Ages (years) 0-1	1-4	5-14	15+	Total
33 Su Dosso	2,019	4,470	5,627	9,421	21,537
34 Su Gaya	1,566	4,307	5,972	8,458	20,303
35 Su Loga	1,568	2,034	2,880	3,469	9,951
3 Di DOSSO	15,804	20,914	28,955	42,211	107,884
41 Su Aguie	1,726	4,158	4,133	4,879	14,896
42 Su Dakoro	1,007	2,093	3,438	7,025	13,563
43 Su Guidan Roumji	1,996	5,171	4,572	5,658	17,397
44 Su Madarounfa	1,807	4,683	4,141	5,124	15,755
45 Su Maradi	3,151	7,795	7,609	12,758	31,313
46 Su Mayahi	2,112	5,473	4,839	5,989	18,414
47 Su Tessaoua	1,956	3,688	4,067	5,166	14,877
4 Di MARADI	13,756	33,061	32,799	46,599	126,215
51 Su Fillingue	1,534	2,453	3,961	6,451	14,399
52 Su Kollo	1,991	3,241	4,095	6,165	15,492
53 Su Ouallam	1,402	1,694	2,361	3,976	9,433

Table 2. Number of PMCs in 1990 (cont.)

ID Cat Administrative Division	PMC rates per 1,000 Ages (years) 0-1	1-4	5-14	15+	Total
54 Su Say	1,523	2,439	3,281	6,427	13,670
55 Su Tera	3,111	4,046	5,280	8,854	21,291
56 Su Tillaberi	2,027	2,721	3,380	6,215	14,343
5 Di TILLABERI	11,588	16,594	22,358	38,088	88,628
61 Su Birni Konni	2,016	5,192	4,419	14,754	26,381
62 Su Bouza	430	1,240	1,497	2,061	5,228
63 Su Illela	1,915	2,813	2,742	3,993	11,463
64 Su Keita	1,021	1,882	3,430	4,757	11,090
65 Su Madaoua	1,538	2,534	3,719	6,246	14,037
66 Su Tahoua	1,692	4,132	5,702	10,449	21,975
67 Su Tchin Tabaraden	502	1,495	2,518	7,444	11,959
6 Di TAHOUA	9,114	19,288	24,027	49,704	102,133
71 Su Goure	3,026	2,433	2,946	5,719	14,124
72 Su Magaria	2,669	4,732	5,569	7,533	20,503
73 Su Matameye	3,079	2,476	2,998	5,820	14,374

Table 2. Number of PMCs in 1990 (cont.)

ID Cat Administrative Division	PMC rates per 1,000 Ages (years) 0-1	1-4	5-14	15 +	Total
74 Su Mirriah	8,118	6,278	7,691	13,128	35,215
75 Su Tanout	1,099	2,068	2,310	6,094	11,571
76 Su Zinder	2,887	5,382	4,009	5,947	18,225
7 Di ZINDER	20,878	23,369	25,523	44,241	114,012
81 NIAMEY	12,846	19,693	24,366	33,183	90,088
TOTAL	90,396	142,751	169,683	280,503	683,332

Table 3. PMC rates in 1990 per 1,000 population

ID Cat Administrative Division	Ages (years)				
	0-1	1-4	5-14	15+	Total
11 Su Agadez	127	232	403	167	193
12 Su Sulit	93	126	168	45	79
13 Su Bilma	89	180	445	122	157
1 Di AGADEZ	113	192	319	121	150
21 Su Diffa	52	143	328	137	141
22 Su Maine Soroa	20	55	143	69	65
23 Su Nguimi	46	112	192	136	121
2 Di DIFFA	37	100	228	107	105

Table 3. PMC rates in 1990 per 1,000 population (cont.)

ID Cat Administrative Division	Ages (years) 0-1	1-4	5-14	15+	Total
31 Su Birni Ngaoure	67	141	267	90	111
32 Su Dogon-Doutchi	118	99	252	53	93
33 Su Dosso	39	107	210	64	80
34 Su Gaya	45	156	336	87	114
35 Su Loga	85	137	303	66	105
3 Di DOSSO	74	122	263	70	98
41 Su Aguie	48	144	224	48	81
42 Su Dakoro	19	48	124	46	49
43 Su Guidan Roumji	45	145	200	45	76
44 Su Madarounfa	45	145	200	45	76
45 Su Maradi	123	380	578	176	238
46 Su Mayahi	45	145	200	45	76
47 Su Tessaoua	44	102	176	41	64
4 Di MARADI	47	141	218	56	84
51 Su Fillingue	26	52	130	39	47

Table 3. PMC rates in 1990 per 1,000 population (cont.)

ID Cat Administrative Division	Ages (years) 0-1	1-4	5-14	15+	Total
52 Su Kollo	40	80	158	43	60
53 Su Ouallam	36	54	117	36	47
54 Su Say	43	87	182	65	76
55 Su Tera	51	82	167	51	67
56 Su Tillaberi	65	108	209	70	89
5 Di TILLABERI	42	75	15	49	62
61 Su Birni Konni	38	122	162	98	97
62 Su Bouza	12	42	79	20	28
63 Su Illela	53	97	148	39	62
64 Su Keita	32	72	206	52	67
65 Su Madaoua	34	71	162	49	61
66 Su Tahoua	33	99	213	71	82
67 Su Tchin Tabaraden	32	118	311	167	148
6 Di TAHOUA	34	89	172	65	73
71 Su Goure	90	90	170	60	82

Table 3. PMC rates in 1990 per 1,000 population (cont.)

ID Cat Administrative Division	Ages (years)				
	0-1	1-4	5-14	15 +	Total
72 Su Magaria	37	81	149	37	55
73 Su Matameye	90	90	170	60	82
74 Su Mirriah	94	90	173	54	79
75 Su Tanout	28	66	114	55	57
76 Su Zinder	106	246	286	77	130
7 Di ZINDER	71	99	169	53	75
81 NIAMEY	152	290	561	139	207
TOTAL	60	118	218	66	88

4.6 Seasonal distribution of malaria

There is a clear correlation between PMC and rainfall. The following graph shows that two months after the onset of the rainy season, the number of PMC starts to increase. The PMC peak is reached some two months after the rainfall peak. Two months after the end of the rainy season, the PMC number decreases to its dry season baseline level.

A preliminary statistical analysis shows a good correlation between monthly rainfall and PMC. To refine the analysis, it would be useful to use rates instead of total number of cases and to prepare a correction factor to account for the increase in the number of health facilities during the 10-year period. It would also be preferable to use a rainfall index reflecting mean rainfall all over the country instead of the rainfall in Niamey only, as was done in this preliminary analysis.

Monthly Rainfall in Niamey in mm

Mon	1981	1982	1983	1984	1985	1986	1987	1988	1989	Mean
Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feb	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mar	0.0	0.2	0.0	0.0	0.4	0.7	43.1	0.1	0.0	4.4
Apr	6.3	15.6	0.0	0.0	0.0	0.1	0.0	4.5	0.8	2.7
May	62.1	33.2	109.3	69.4	0.6	65.8	22.0	0.1	6.3	43.6
Jun	71.5	35.0	145.1	41.6	68.2	37.4	10.3	73.3	24.6	59.9
Jul	276.9	73.9	160.3	63.2	108.6	83.3	114.0	154.3	125.3	130.2
Aug	47.7	142.3	92.7	57.4	115.3	118.6	123.8	166.6	302.7	124.2
Sep	53.6	43.3	97.3	42.9	103.2	95.6	58.6	97.6	148.0	87.0
Oct	0.1	4.9	1.3	19.3	0.0	10.6	10.1	2.5	8.3	5.7
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**518.1**	**348.4**	**606.0**	**293.8**	**396.3**	**412.0**	**381.9**	**498.9**	**616.0**	**457.8**

PMC Number

Mon	1981	1982	1983	1984	1985	1986	1987	1988	1989	Mean
Jan	31124	21117	19876	23609	25103	28734	30725	35740	27415	20280
Feb	25700	15006	24251	24709	26227	35334	30297	39373	29360	20850
Mar	21470	23358	15553	28912	22890	36780	33100	36759	24358	20265
Apr	18711	28200	14393	16946	33396	32081	19757	30505	19589	17800
May	18495	21154	19481	17512	23519	25779	21127	24217	17108	15700
Jun	17282	21428	14887	16162	28591	24981	20274	24292	25633	16130
Jul	25502	27422	25101	23427	15894	34480	27423	30008	48244	21460
Aug	58293	42112	35191	27025	71359	67717	26612	68744	91986	40750
Sep	60764	77666	61698	144915	130348	100289	154325	15798	99226	70420
Oct	60615	52604	62154	40735	194923	111372	185026	47110	33909	65700
Nov	26352	32544	37022	32983	42345	76680	41527	81931	49828	35100
Dec	28964	28208	24642	30883	2573	43428	28390	50958	36188	22850
Totl	**393272**	**390819**	**354249**	**427818**	**617168**	**617655**	**618583**	**485435**	**502844**	**367320**

Correlation Between Rainfall and PMC*

Source	df	Sum of squares	Mean square	F
Regression	1	3797512007.4	3.79 E+9	5.69
Residuals	106	70777389143.5	6.67 E+8	
Total	107	74574901150.9		
B Coefficients	B	Conf interval 95%		

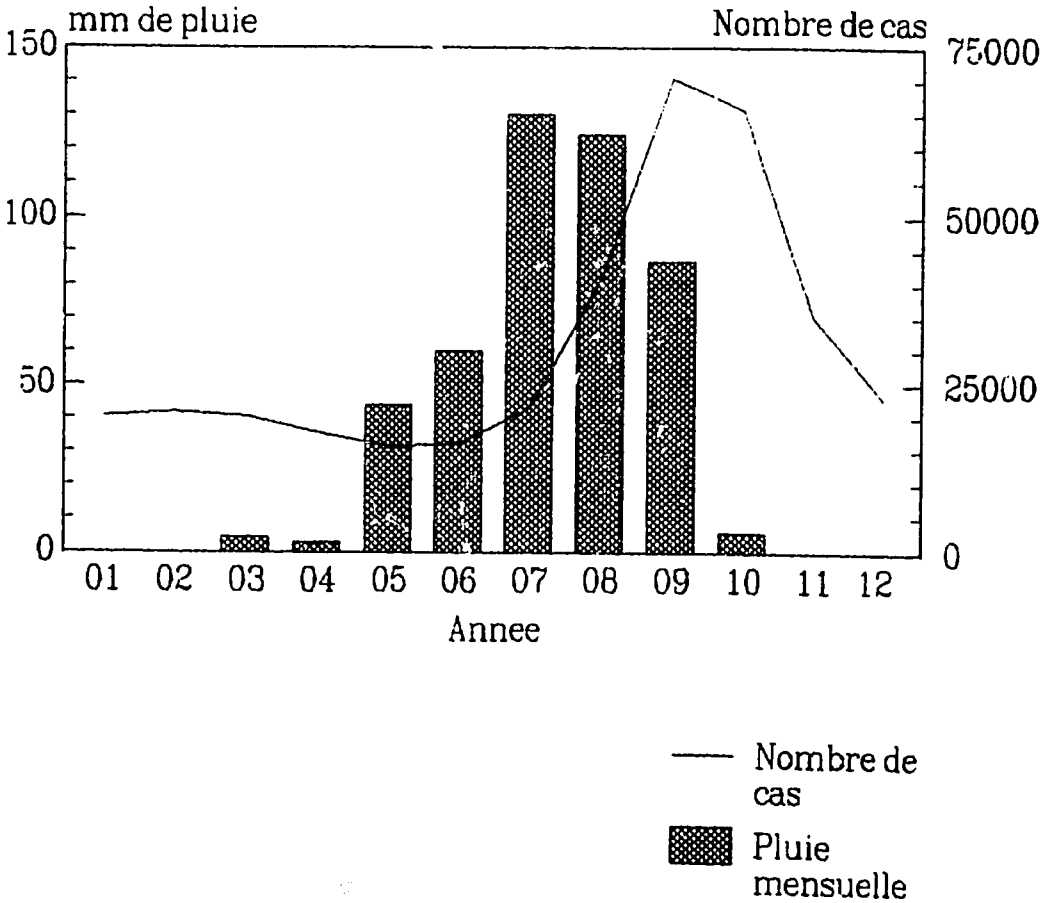
Variable	Moy	coef	Low	High	Standard Error	Y-Intercept
Rain	37.70	101.66	18.10	185.21	42.62	35128

*The correlation coefficient is $r=0.23$, $r^2=0.05$ with a confidence interval of $0.04 < R < 0.40$.

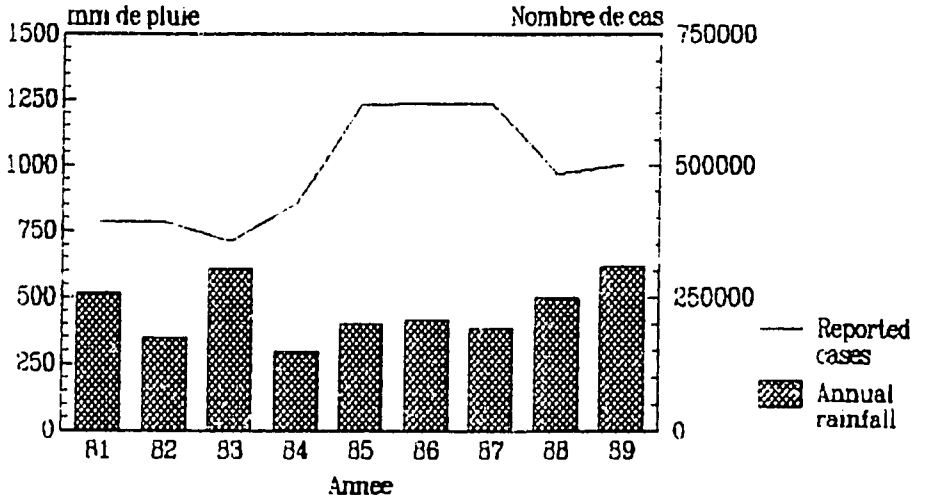
Although there is a good seasonal correlation between rainfall and PMC, this does not hold true for the correlation between a rainy and a dry year. The following graph shows that the rainier years were not always the ones with the higher number of PMC.

Another interesting observation is that the main differences between low and high PMC years are the result of different PMC rates during the rainy season.

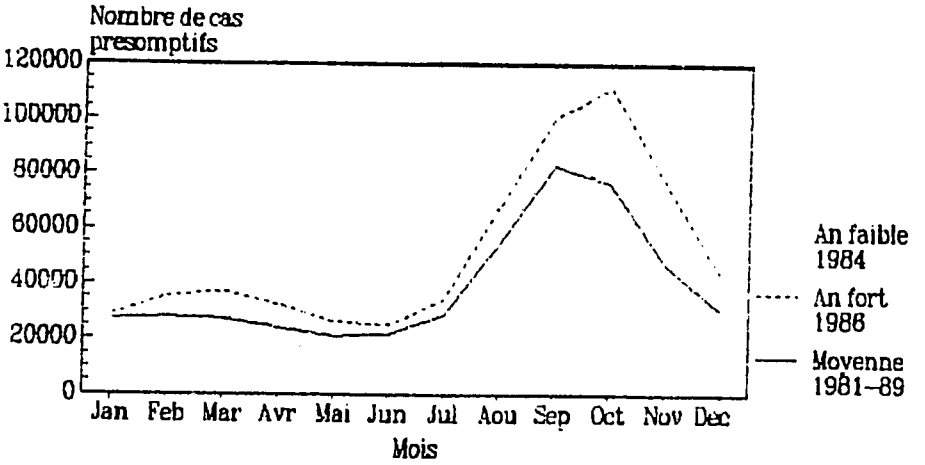
Pluviometrie et nombre de cas presumes de paludisme par mois (moyennes faites sur 1981–1989)



Pluviometrie et nombre de cas presumes
de paludisme de 1981 a 1989



Variations saisonnieres
du nombre de cas presumes de paludisme



Annex 3

Summary of Sociologic Studies

LUTTE CONTRE LE PALUDISME: ETUDES SOCIOLOGIQUES

Méthodologie suivie lors de la pré-enquête (septembre 1991)

L'idée initialement adoptée par l'équipe était de chercher une corrélation entre l'étude épidémiologique (prise de sang, température, examen de la rate) dans les concessions et les CAP d'un échantillon des habitants des mêmes concessions. Dans cette perspective 3 questionnaires ont été élaborés: 1) "Mortalité/avortement rétrospective: un an" (pour compléter la "fiche concession" préconisée dans l'étude épidémiologique), 2) "Morbidité/comportement rétrospective: un mois" (prévu pour chaque sujet de l'étude épidémiologique se plaignant d'un accès palustre récent) et 3) "Connaissances, Attitudes, Pratiques" (CAP), à passer à un échantillon de 6 personnes par concession représentant les 2 sexes et 3 classes d'âge: 12-24, 25-44 et 45 ans et plus.

Cette conception de l'étude a été modifiée dès la première sortie de l'équipe sur le terrain (Akaranna), vu la difficulté pratique de mener l'étude médico-épidémiologique dans les concessions. La décision de baser l'échantillon épidémiologique par village sur l'ensemble des enfants de 0 à 9 ans a permis de simplifier l'enquête sociologique, 1) en éliminant la recherche de corrélations avec les résultats épidémiologiques et 2) en mettant moins l'accent sur l'étude par concession et plus sur un échantillon représentatif du village.

Ainsi 1) le questionnaire "Mortalité/avortement" a été éliminé et 2) le questionnaire "Morbidité/comportement" a été systématiquement passé à tous les répondants à l'enquête sociologique (en y ajoutant la question de la date approximative du dernier accès palustre) suivi par le questionnaire "CAP".

Les mêmes deux questionnaires ont été passés au niveau du dispensaire à la majorité des consultants pour lesquels la fiche "cas fébrile" a été remplie, afin de permettre une comparaison avec les réponses recueillies au village. (Les éventuelles différences constatées pourraient refléter, d'un côté, des particularités du village par rapport à la région, et de l'autre côté, des particularités des utilisateurs des services sanitaires par rapport à la population générale.)

Arrivés au village, le premier entretien a été avec le chef de village (en tête à tête à Akaranna, Momboye Tounga et Boukoki II; entouré d'une vingtaine de chefs de famille à Dagoigé) afin de recueillir les informations générales sur le village qui figurent dans l"Aperçu du village" (voir annexe). Ensuite les questionnaires "Morbidité/comportement" et "CAP" ont été passés à certaines personnes identifiées comme influentes sur le plan sanitaire et/ou général: chef de village, marabout/imam, guérisseurs traditionnels, secouriste, matrone. Quelques informations supplémentaires ont également été recueillies auprès de ces "décideurs". L'échantillon a été complété en choisissant au hasard un nombre limité de répondants "ordinaires". A Dagoigé et à Momboye Tounga la technique

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des "Focus Groups" a été utilisée pour recueillir les mêmes informations auprès d'un groupe de jeunes mères et (à Momboye Tounga seulement) d'un groupe de jeunes hommes.

A Akaranna les entretiens ont eu lieu en tamasheq: un élève de CEG a servi d'interprête et ensuite d'enquêteur, ayant rapidement maîtrisé le remplissage des questionnaires. A Dagoigé les entretiens ont eu lieu en haoussa et à Momboye Tounga (village dendi) en zarma (parler très proche du dendi) et en haoussa. On a pris note de certains termes locaux pertinents pour l'étude du paludisme.

Conclusions préliminaires: méthodologie et instruments

Il a été impossible d'éviter le biais le plus évident dans une enquête de ce genre: les enquêteurs sociologiques étaient bien obligés de présenter leur mission comme relevant des services de la sante. Il est possible que certains répondants aient effectivement ete réticents à parler de leurs croyances ou pratiques traditionnelles à des "représentants de la santé moderne". Néanmoins un grand nombre d'enquêtés - y compris des secouristes, qu'on pourrait supposer particulièrement enclins à favoriser la médecine moderne - ont révélé apparemment sans gêne leur intégration de pratiques traditionnelles et modernes.

[illegible] fournissant des informations pertinentes et suffisamment explicites pour être remplis par un enquêteur sans formation préalable.
L'entretien de groupe, tout en fournissant des informations intéressantes et en permettant de recueillir des données sur plusieurs personnes à la fois (ex. constat du niveau élevé de décès infantiles dans une population donnée), tend parfois à être dominé par un ou deux individus pour des raisons sociales pas nécessairement apparentes à l'enquêteur. Ces individus "dominants" (peut-être mieux éduqués ou plus en contact avec les services modernes) connaissent parfois les "bonnes réponses" (modernes) qui ne reflètent pas nécessairement les convictions profondes de la majorité.

Vu que suite à la redéfinition de l'enquête, les 2 questionnaires "morbidité/comportement" et "CAP" ont été passés aux mêmes individus, il a été décidé de les combiner en un seul questionnaire "CAP".

Au niveau du dispensaire il a été constaté que le questionnaire "morbidité" répète certaines questions déjà traitées dans la fiche "cas fébrile": ceci indiquait la nécessité d'un deuxième questionnaire sociologique adapté pour l'enquête au niveau de l'unité de soins.

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Nouveaux questionnaires

En fonction de ces observations, au retour de l'équipe à Niamey, les questionnaires CAP ont été reprises. Certaines questions ont été reformulées et d'autres ajoutées (ex. protection des femmes enceintes? qui dort sous moustiquaire?) afin de cibler davantage les connaissances, attitudes et pratiques particulières des individus interviewés lors de l'enquête prévue en février 1992. Ceci reflète une nouvelle optique par rapport à l'enquête préliminaire, qui visait surtout à découvrir la gamme de connaissances, attitudes et pratiques existantes au niveau du village et de la région. La prochaine enquête portera sur un échantillon plus vaste et plus représentatif dans la perspective d'une analyse non seulement qualitative mais également quantitative (corrélation de certaines CAP avec des facteurs d'âge, de sexe, de niveau éducatif etc.) afin d'avoir une meilleure compréhension des variations en connaissances, attitudes et pratiques des différents groupes-cibles.

Dans les nouveaux questionnaires CAP les questions ouvertes ont été maintenues pour les raisons suivantes: 1) le remplissage est plus facile à maîtriser pour les enquêteurs que le codage de réponses pré-établies et les risques d'erreur par inattention sont moins importants; 2) il y a moins de risque que l'enquêteur "suggère" certaines possibles réponses apparaissant sur sa fiche au répondant; 3) les questions ouvertes donnent plus de possibilités de recueillir des informations qualitatives nouvelles.

Néanmoins le dépouillement des questionnaires utilisés lors de l'enquête préliminaire indique que certaines questions ouvertes appellent des réponses équivalentes chez plusieurs répondants (voir "Résultats dépouillement questionnaires sociologiques" en annexe). Ces réponses "fréquentes" pourraient donner la base pour une fiche de codage quantitatif des questionnaires ouverts, en laissant également la possibilité d'expliciter qualitativement la réponse "autre" (codée "9").

Les nouveaux questionnaires ont été testés sommairement dans le quartier Boukoki II de Niamey par 2 enquêteurs sans formation préalable. Le temps de remplissage par questionnaire a varié entre 5 et 10 minutes. Les résultats, satisfaisants, pourraient être améliorés par une brève formation (maximum 1 jour, y compris une pratique sur le terrain) afin d'amener les enquêteurs 1) à écrire la réponse à <u>toutes</u> les questions (y compris "ne sait pas", "ne répond pas", etc.), et 2) à pousser le répondant à donner une information complète (ex. dosage exact et prix des médicaments achetés).

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CONCLUSIONS PRELIMINAIRES DE L'ENQUÊTE SOCIOLOGIQUE

(Pour des informations plus détaillées sur chaque localité, voir en annexe "Aperçu du village" et "Résultats dépouillement questionnaires sociologiques")

Limitations de la pré-enquête

Si l'homogénéité relative des 3 localités rurales et le temps consacré à l'enquête (1-2 jours) dans chacune a permis d'esquisser les grandes lignes de leurs situations respectives et des CAP en matière de paludisme de leurs populations, par contre les résultats de l'enquête au niveau du quartier urbain de Boukoki doivent être considérés comme extrêmement préliminaires et partiels, vu le peu de temps dont disposaient les enquêteurs, la taille réduite de l'échantillon et l'hétérogénéité de la communauté.

Dans toutes les 4 localités une enquête systématique, basée sur un échantillon bien plus vaste et représentatif, est nécessaire pour fonder, compléter ou infirmer ces premières impressions ainsi que pour établir la distribution dans la communauté des différentes connaissances, attitudes et pratiques dans le domaine du paludisme.

Cette pré-enquête a surtout permis de déblayer le terrain et de faire un certain nombre d'observations générales concernant les différentes communautés et leurs croyances et pratiques face au paludisme.

Comparaison globale des 4 communautés

Boukoki II, en tant que quartier urbain, contraste avec les 3 communautés rurales étudiées par: 1) sa population vaste (ca. 8000), instable et hétérogène, 2) son accès facile à l'eau potable, à l'électricité, à une alimentation variée, aux produits manufacturés etc., 3) l'implantation d'un complexe sanitaire moderne et spécialisé pour différents groupes-cibles et l'accès facile aux produits pharmaceutiques. La population comporte presque exclusivement des immigrés récents à la capitale.

Akaranna, en zone sahélo-saharienne, est peuplé de Touaregs et de Bouzous récemment sédentarisés dans la région où ils pratiquaient traditionnellement la transhumance.

Dagoigé, dans la zone sahélienne, est peuplé surtout de cultivateurs Haoussa d'origines diverses, avec quelques familles Bouzous et Peuls.

Momboye Tounga, situé en zone soudanienne sur le fleuve Niger, a comme groupe dominant les pêcheurs Dendis (ethnie songayphone) qui habitent le village central. Des quartiers périphériques sont réservés respectivement aux pêcheurs Haoussas et aux éleveurs Peuls.

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Les 3 communautés rurales ont en commun de se retrouver actuellement appauvries par rapport à une situation antérieure plus aisée. Akaranna a perdu le gros de ses troupeaux dans les sécheresses de 1974 et 1984. Dagoigé relève d'une région favorisée dans les années 1960 et 1970 par la commercialisation de l'arachide. A Momboye Touga, les pêcheurs Sorko constatent la baisse depuis une dizaine d'années du volume de poissons dans le fleuve, ce qui pousse les jeunes à chercher des poissons dans les pays voisins.

Structures éducatives: Akaranna et Momboye Tounga disposent d'une école primaire. A Dagoigé le taux de scolarisation a baissé, les parents hésitant à envoyer leurs enfants au village voisin.
La forme d'éducation la plus répandue est l'école coranique.
Des centres d'alphabétisation existent dans les 3 localités rurales.
Partout les mâles ont plus accès à l'éducation et à la formation que les filles et les femmes.

Particularités sanitaires: A Dagoigé on constate un nombre élevé de dermatoses, ainsi que plusieurs cas (rapportés par les mères) d'hématurie. Le nombre d'enfants visiblement malnutris frappe également, particulièrement dans cette zone de récoltes adéquates et de petit élevage. Selon l'infirmier de Kona, la population préfère vendre sa récolte au Nigéria pour avoir de l'argent liquide plutôt que de la consommer elle-même. Le bétail est attaché dans les concessions à une certaine distance des habitations.

A Momboye Tounga, par contre, les enfants apparaissent bien nourris (récoltes abondantes, régime à base de poisson), mais on voit plusieurs victimes de poliomyélite. L'hygiène villageoise laisse à désirer et les animaux divaguent partout.

Dans les deux villages sédentaires on constate un problème de mariage précoce, et des taux élevés de natalité et de mortalité infantile.

A Akaranna, on est frappé par la petite taille des habitants (liée peut-être à des périodes de malnutrition?). Le nombre d'enfants par femme semble moins important que dans les zones sédentaires, mais le mariage précoce reste un problème.

Ressources en eau: Aucun des 3 villages ne dispose d'un forage. Les habitants cherchent l'eau de boisson dans des puits (dans ou près du village) et utilisent l'eau des mares (à Akaranna et Dagoigé) ou du fleuve (à Momboye Tounga) pour abreuver les animaux, jardinage, lessive, etc.

Equipe de santé villageoise: Les 3 villages sont dotés d'ESV. L'activité principale effectuée par les matrones est d'assister aux accouchements. Les 2 matrones interviewées (Dagoigé et Momboye Tounga) ne se souvenaient pratiquement plus du volet "chimioprophylaxie de la femme enceinte" qui normalement fait partie de leur formation.

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Le secouriste d'Akaranna est surtout sollicité par la population en tant que vendeur de chloroquine et d'aspirine; ceux de Dagoigé se déplacent de marché en marché, ce qui les rend moins disponibles pour leur communauté; le secouriste de Momboye Tounga est en même temps herboriste et zima (spécialiste des rituels de possession), 3 activités qu'il concilie apparemment sans problèmes.

Guérisseurs traditionnels: Le **marabout** soigne avec des versets du Coran (textes insérés dans des amulettes ou encre à boire ou à verser sur le corps, également prières orales et imposition des mains, ex. sur la tête pour soigner les céphalées).
L'**herboriste** soigne avec des feuilles et des écorces, en décoction (à boire ou pour rinçage du corps) ou réduits en pâte pour application sur le corps. Les membres ordinaires de la communauté connaissent souvent un certain nombre de remèdes traditionnels à base de plantes.
Le **"zima"** (Zarma) ou **"boka"** (Haoussa) soigne surtout certaines affections psychologiques (ex. dépressions) à travers des rituels de possession: "folley foori" (Z) ou "bori" (H).

Distribution des différents types de guérisseurs traditionnels dans les 3 villages:
Akaranna: 2 marabouts (dont le chef de village). Pas d'herboriste, mais tous les habitants pratiquent certains soins à base de plantes.
Dagoigé: 10 marabouts, 7 herboristes. Certains combinent des soins coraniques, magiques et herborisme. Pas de boka.
Momboye Tounga: 4 marabouts (dont l'imam), 2 herboristes (dont le chef de village) et 2 zima (le secouriste et une femme). Certains marabouts et les zimas pratiquent aussi l'herborisme. Un "faiseur de noeuds" spécialisé en convulsions.

CONNAISSANCES, ATTITUDES ET PRATIQUES

Dans les 3 localités, les répondants semblent avoir intégré à leur niveau croyances et soins modernes et traditionnels par rapport au paludisme.

On constate une certaine corrélation entre le niveau éducatif et les connaissances modernes sur le paludisme, ainsi qu'avec le fait d'avoir voyagé en dehors de sa région habituelle. Certains sous-groupes, ex. les femmes, les Bouzous, semblent défavorisés à cet égard.

Accès palustre récent: En milieu rural presque 100% des répondants rapportaient un épisode de paludisme relevant de l'hivernage 1991. Par contre, 50% des répondants urbains (Boukoki II) situaient leur dernier accès palustre bien avant l'hivernage écoulé.

Recours au dispensaire: Dans toutes les localités les répondants se plaignent du manque de produits au niveau du centre de soins. Néanmoins le non recours au dispensaire semble être surtout lié à l'éloignement du dispensaire (ou du dépôt pharmaceutique: Momboye

Tounga) et aux moyens nécessaires pour s'y rendre. A Boukoki II pratiquement tous les répondants s'adressent directement aux services sanitaires du quartier en cas de maladie; à Dagoigé on n'hésite pas en cas de complication à se rendre au DR de Kona à 4 km. A Akaranna, situé à 15 km du dispensaire, on préfère se soigner au village. A Momboye Tounga, malgré la proximité relative du DR de Tanda (5 km), on hésite à s'y rendre, sachant qu'en toute probabilité on recevra une ordonnance qu'on ne pourra acheter qu'à Gaya (20 km de Tanda, produits chers) ou à Dosso (à 150 km de Gaya). Peu de répondants ont évoqué la possibilité d'avoir des injections comme un motif d'aller au dispensaire.

Recours à l'automédication: Surtout dans les localités plus éloignées du centre de soins (ou des dépôts pharmaceutiques), les habitants cherchent en premier lieu à se soigner sur place, soit traditionnellement, soit à la chloroquine et à l'aspirine, procurées auprès du secouriste (sans qu'une consultation ait lieu), au dépôt pharmaceutique, ou gardées d'un contact antérieur avec les services de santé.

Dosage de chloroquine: La tendance générale, aussi bien chez les secouristes que chez les répondants ordinaires (ceux pour lesquels des données suffisamment détaillées ont pu être obtenues) est d'appliquer un dosage de chloroquine trop faible même par rapport à l'ancienne stratégie (dose unique). Une petite minorité connaît et applique la dose correcte (2 répondants à Akaranna). 2 des 3 secouristes interviewés connaissent l'(ancien) dosage correct mais ne l'appliquent pas régulièrement. Il est plutôt rare que le malade se laisse guider par le secouriste en cas de paludisme: souvent il achète 2 ou 3 comprimés en fonction de ses moyens et rachète la dose en cas de non-amélioration. Cette stratégie peut refléter 1) l'ignorance de la dose correcte et de l'importance de la respecter, 2) la crainte d'une surdose d'un produit considéré comme toxique (associé dans l'esprit des populations avec des tentatives d'avortement ou de suicide), et 3) des considérations financières (malgré le faible prix de la chloroquine: ca. 10 FCFA par comprimé).

Connaissance de la maladie: Les symptômes rapportés concordent généralement assez bien avec le tableau clinique du paludisme; il y a quelques cas de confusion avec d'autres maladies, ex. le rhume. On constate une différence assez marquée entre les symptômes rapportés de la propre maladie et les signes par lesquels on peut décéler un paludisme chez un autre.

Connaissance de la saison: Pratiquement tous les répondants situaient le paludisme surtout pendant et immédiatement après l'hivernage (ce qui concorde avec les noms haoussa et zarma de cette maladie). Beaucoup moins faisaient le lien avec la présence massive des moustiques en saison des pluies.

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Connaissance du vecteur: La plupart des répondants identifiaient correctement l'environnement où le moustique pond ses oeufs. Curieusement, certains qui avaient identifié le moustique come cause du paludisme (question no. 23) soulignaient plutôt son aspect dérangeant (démangeaisons/empêcher de dormir) en réponse à la question no. 29, s'il fait du tort aux êtres humains.

Lutte contre les moustiques: Les 3 communautés rurales sont situées à proximité de l'eau: Momboye Tounga sur le fleuve Niger et Akaranna et Dagoigé à côté de mares saisonnières. Les 4 communautés se plaignent de la présence massive des moustiques pendant et immédiatement après la saison pluvieuse et connaissent l'utilisation des moustiquaires. A Momboye Tounga elle est systématique pour tous, adultes et enfants (qui dorment 2 ou 3 par moustiquaire), reflétant peut-être la plus forte concentration de moustiques de la zone soudanienne et/ou la prospérité relative de cette communauté. A Dagoigé l'utilisation des moustiquaires (réservée aux adultes) a diminué avec l'appauvrissement progressif de la région. A Akaranna les concessions visitées étaient pourvues de moustiquaires, utilisées par les adultes. A Boukoki, l'utilisation de la moustiquaire est variable et semble être liée aux connaissances modernes sur la transmission du paludisme. D'autres moyens de protection mentionnées sont les insecticides, les insectifuges modernes et traditionnels (ex. brûler des feuilles de neem). Des amulettes à base de versets du Coran ou à base d'herbes et de charmes magiques peuvent être commandées auprès des tradipraticiens en début de la saison des pluies pour permettre de la traverser en bonne santé. Plusieurs répondants mentionnent la chimioprophylaxie des enfants.

Conséquences du paludisme: Le lien entre paludisme et avortement semble généralement inconnu (à part à Dagoigé, où certains répondants cite la fièvre parmi les causes de l'avortement), ainsi que la chimioprophylaxie des femmes enceintes. Surtout à Akaranna la population lie les convulsions à la fièvre, tandis qu'à Dagoigé et à Momboye Tounga elles sont plutôt attribuées à des causes surnaturelles, "la peur" etc.

Traitement des convulsions: A Akaranna on préconise surtout une douche fraîche. A Dagoigé on incise le front de l'enfant (on croit que si le sang sort, il guérira), ou bien on le lance à répétition sur le toit d'une case. A Momboye Tounga on peut amener l'enfant chez un guérisseur spécialisé qui fait des noeuds dans des fils rouges et blancs qu'il attache ensuite autour du cou et des reins du malade.

REMARQUES PARTICULIÈRES

Maintien de CAP dépassées: Parmi les moyens de prévenir le paludisme certains répondants ont cité la chimioprophylaxie des enfants (ancienne stratégie). Selon leurs dires ils appliquent cette chimioprophylaxie irrégulièrement, en fonction de la disponibilité de chloroquine, et à une dose uniforme indépendante

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de la taille de l'enfant. Ceci confirme le bien-fondé de l'abandon dans la stratégie nationale de la chimioprophylaxie des enfants, mais souligne également la nécessité, lors de l'introduction d'un nouveau programme, de sensibiliser le groupe-cible non seulement concernant les avantages des nouvelles pratiques proposées, mais aussi concernant les raisons de l'abandon de l'ancienne stratégie.

Potentialité de confusion entre insecticide et insectifuge: Plusieurs répondants ont mentionné les insecticides comme moyen de protection contre les moustiques. L'enquête suivante devrait chercher à approfondir l'utilisation exacte qui est faite de ces produits toxiques: par ex. un individu (hors échantillon à Niamey) a été découvert en train d'appliquer l'insecticide sur sa peau pour décourager les moustiques de le piquer - il fait ceci toutes les nuits depuis 6 ans. D'autres utilisent l'insecticide comme un aérosol désodorant.

Quelle politique envers l'automédication? L'importance apparente du recours à l'automédication suscite les questions suivantes: 1) A quel point cette tendance est-elle répandue dans les 4 localités? (un échantillon élargi et plus représentatif permettrait d'y répondre). 2) Quelle doit être la politique du MSP envers l'automédication: la décourager en faveur d'un soutien aux ASV ou corriger les pratiques automédicatives des populations par une EPS appropriée?

Résultats du CAP et implications pour un programme d'EPS
Globalement parlant, les différentes lacunes constatées au niveau des connaissances, attitudes et pratiques en matière de lutte contre le paludisme dans les 4 communautés visitées - symptômes, causes et conséquences du paludisme, son traitement et prévention - correspondent assez exactement à la série de messages éducatifs véhiculés dans le "paquet" de matériels d'EPS sur le thème "Paludisme" récemment développés et testés à l'ARIEPS de la DDS de Tillaberi.
Cet ensemble de matériels comporte une pagivolte (60 x 40 cm) en couleurs imprimée sur tissu, avec sa fiche pédagogique (mode d'emploi pour le personnel sanitaire) et matériels pour distribution à différents groupes-cibles: livret scolaire (niveau CM1/2), livrets en haoussa et zarma (centres d'alphabétisation), feuilles volantes reprenant les images/messages principaux de la pagivolte pour distribution au niveau du centre de soins, dans le village ou lors de sorties foraines.
Il est suggéré, dans le cadre de la phase suivante de l'enquête, d'explorer les possibilités d'adapter ce matériel déjà existant aux besoins du Programme National de Lutte contre le Paludisme - par exemple, un accent particulier devrait être mis sur le dosage curatif correct de la chloroquine - et de tester son impact au niveau des 4 localités impliquées dans l'étude (voir paragraphe suivant).

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Quel rôle pour les ASV et guérisseurs traditionnels? Un des objectifs de la pré-enquête, en s'entretenant en priorité avec les différents intervenants sanitaires au niveau villageois, était d'accumuler des informations sur ces personnes-ressources potentielles dans la perspective d'une intervention ultérieure dans le domaine du paludisme. Le but était non seulement de mieux connaître les acteurs sanitaires des localités étudiées mais également d'avoir une idée générale des attitudes aussi bien des ASV - considérés par les services sanitaires modernes comme leurs représentants au niveau villageois - et des guérisseurs traditionnels, souvent supposés être réticents envers les connaissances modernes.
Dans les 3 localités visitées, les contrastes en connaissances, attitudes et pratiques entre les ASV et les tradipraticiens étaient beaucoup moins marqués que prévus. Les 2 groupes, à l'instar des autres villageois, intègrent des croyances et pratiques traditionnelles et modernes et trouvent tout à fait naturel qu'il y ait une complémentarité entre les deux. Il y a souvent collaboration entre ASV et guérisseurs traditionnels: ils se réfèrent réciproquement des malades qu'ils considèrent comme relevant plutôt des compétences de l'autre; les guérisseurs traditionnels réfèrent également certains malades au dispensaire et n'hésitent pas à s'y rendre eux-mêmes en cas de maladie. Le cas le plus frappant de cette intégration de médecines moderne et traditionnelle est le secouriste de Momboye Tounga qui est en même temps herboriste et zima.

Pour la réussite d'une intervention dans le domaine du paludisme il serait important de respecter dans la mesure du possible la symbiose existant entre médecines traditionnelle et moderne aussi bien dans l'esprit des gens que dans l'organisation de leur communauté. On pourrait par exemple démarrer l'intervention dans chaque village par des séances d'Information/Education/Communication (IEC) en petits groupes comportant le chef de village, les notables, les guérisseurs traditionnels, et les ASV, dans l'espoir que ces personnes influentes puissent à leur tour véhiculer dans la communauté les CAP essentielles en matière de lutte contre le paludisme.

PREVISIONS POUR L'ENQUÊTE DE FEVRIER 1992: VOLET SOCIOLOGIQUE

1. Au niveau central: concertation avec les autres membres de l'équipe concernant le calendrier et la coördination des recherches, ainsi que la mise au point du matériel d'Education Pour la Santé portant sur le paludisme.
Réalisation du matériel d'EPS en quantité suffisante pour couvrir les besoins des 4 localités retenues pour une période de six mois (jusqu'à l'enquête de l'hivernage 1992).

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2. Dans chacune des 4 localités et en collaboration avec le responsable départemental de l'ARIEPS (Antenne Régionale d'Information et d'Education Pour la Santé):

1er jour: Former 3 enquêteurs sociologiques pour le remplissage du nouveau questionnaire CAP avec pratique sur le terrain. Afin de recueillir un échantillon adéquat, il est prévu de former par localité: un homme et une femme pour mener l'enquête dans la communauté et une personne pour remplir les questionnaires CAP en complément à la fiche "cas fébrile" au niveau du dispensaire.

2ème jour: Encadrer les 3 enquêteurs sur le terrain et compléter les informations manquantes pour l'"Aperçu du village" des 4 localités, y compris des entretiens avec d'autres guérisseurs et décideurs locaux.

3ème jour: Former le personnel du centre de soins de référence pour l'exploitation du matériel d'EPS sur le paludisme. Remise d'un stock adéquat pour couvrir les six mois suivants.

4ème jour: Départ dans la localité suivante. Les enquêteurs poursuivent leurs recherches sous la supervision du responsable ARIEPS jusqu'à obtention de l'échantillon complet prévu: à peu près 60 questionnaires dans la communauté et le nombre total de cas fébriles rencontrés au cours de 5 jours au niveau du centre de soins. Le responsable ARIEPS assurera l'acheminement des questionnaires complétés au niveau central.

3. Au niveau central: dépouillement des questionnaires CAP pour obtention des informations qualitatives et quantitatives concernant les 4 localités: analyse et présentation écrite des résultats.

Prévisions pour l'enquête de l'hivernage 1992: volet sociologique

1. Au niveau central: concertation avec les autres membres de l'équipe concernant le calendrier et la coördination des recherches.

2. Dans les 4 localités: répétition de l'enquête CAP pour constater d'éventuelles modifications intervenues dans les réponses de la population suite à l'introduction du matériel d'EPS sur le paludisme.

3. Au niveau central: dépouillement, analyse et présentation des résultats avec recommandations pour de futures interventions au niveau socio-éducatif dans le domaine de la lutte contre le paludisme.

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