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and Control Project

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

April - May, 1992

by

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Acronyms

AES	Average Enlarged Spleen
AS	Average Spleen
BO	Boukoki District of Niamey
DA	Village of Dagouajé
DSEP	Division of Epidemiologic Surveillance and Prevention
DSP	Division of Study and Planning
Exam	Examined
IN	Rural Dispensary of Intuila
JO	Village of Djoura
KAP	Knowledge, Attitudes, and Practices
KO	Rural Dispensary of Kona
MCH	Maternal and Child Health
MOPH	Ministry of Public Health
MO	Village of Monboye
NMCP	National Malaria Control Program
NSPH	National School of Public Health
Pos	Positive
Prev	Prevalence
TA	Rural Dispensary of Tanda
VHW	Village Health Worker

Executive Summary

The Ministry of Public Health (MOPH) of Niger requested the assistance of USAID to study malaria: its transmission; its impact on health; its management by the health services; and the knowledge, attitudes and practices of the population regarding the disease. This dry-season study follows a preliminary study carried out in September-October 1991 during the rainy season.

Parasitologic surveys showed important differences in the epidemiology of malaria in different villages within the same area, and from one season to the other. Although there were a sharp decrease in malaria from rainy to dry season, there was a fair number of malaria infections during the dry season. A thorough knowledge of the epidemiology is necessary to guide the clinician in the management of malaria and fever.

The distribution and prevalence of *Anopheles* is very different in the dry season. In large areas there are no breeding places suitable for *Anopheles* — for example, in the villages of the Sahelian or Saharan zones, which have no surface bodies of water a few months after the end of the rainy season. Some heavily polluted permanent surface waters are no longer suitable for *Anopheles* during the dry season, allowing only culicine breeding. Along the Niger river, suitable breeding sites can be found during the dry season, although *Anopheles* densities are lower than those observed during the rainy season.

In spite of a very low level of education and literacy among a majority of the population, there was a fair knowledge about malaria, its transmission, and its treatment. Practically all rural residents have suffered from malaria. The roles of mosquitoes and the rainy season and treatment with chloroquine are fairly well known. Educated individuals have a better understanding of malaria. This knowledge seems to have led to a lower mortality rate among children of educated women.

A high proportion of the population attributed diseases to natural causes; magic and religion were less often invoked as causal factors. Thus a health education campaign probably would be fairly well accepted.

Medical services, dispensaries, village health workers, and medical centers are well-accepted by the population. They are well-used when available. Distance and lack of supplies are the main impediments to their extended use.

This study provided a detailed understanding of the knowledge, attitudes, and practices of the population regarding malaria. This understanding would be useful for planning a health education campaign.

The most important conclusions of the epi-clinical studies are:

1. The practitioners are fairly proficient at diagnosing malaria.
2. A correct diagnosis does not mean a correct treatment will be recommended.
3. Chloroquine is prescribed in insufficient doses.
4. Injectable quinine is overused.
5. Duration of treatment is too short.
6. Practitioners are not taking the time necessary to motivate patients to comply fully with the prescriptions.

This study shows that personnel from MOPH are capable of carrying out multidisciplinary studies including parasitology, entomology, and sociology. The parasitologists, entomologists, and sociologists have adequate technical skills. The Nigerienne personnel carried out the surveys. The computer system in place at the National Information System (SNIS) is perfectly adequate for handling and analysis of the data collected.

Supplemental studies could easily be carried out at affordable costs if study sites were not too far from Niamey. In a later stage, they could be carried out in more remote areas after proper training of the health personnel from those areas.

This study and the previous rainy-season study have shown some of the major problems the National Malaria Control Program (NMCP) has to contend with and have provided information necessary to address these problems.

1. Introduction

1.1 Background Information

To address the need to update information on the malaria situation in Niger and to strengthen the capacity to evaluate it, the Ministry of Public Health (MOPH) requested technical assistance from USAID.

A planning consultation (Phase I) took place in September and October 1991 (Ratard, Manguin-Gagarine, White 1991). The final report of this consultation described the situation, the solutions proposed, and the study protocols. The main objectives of this capacity-building plan are reviewed below.

1.2 Overall objectives

The main objective expressed by the MOPH was to complete a national study of the malaria situation that would provide the baseline information on which to base 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, requiring a qualitative and quantitative study of the control measures applied.

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

This study was part of the development of health services that integrate malaria control with other services. It was important that the study would:

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

1.3 Scope of Work

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

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

1. Carry out the study protocol on the malaria situation in Niger prepared in October 1991 (Ratard, Manguin-Gagarine, White 1991).

2. Update this protocol in a planning workshop with MOPH and USAID/Niamey personnel.

3. Carry out an introductory workshop with MOPH and local representatives.

4. Carry out parasitologic and clinical surveys in the selected sites according to the study protocols prepared previously, taking into consideration practical changes as necessary.

5. Carry out the entomological study in the selected sites according to the study protocols prepared previously, taking into consideration practical changes as necessary.

6. Analyze the data qualitatively and quantitatively.

7. Organize a workshop to discuss the study results, the problems encountered, and the possible solutions. This workshop will include the study team and personnel from MOPH and USAID.

8. Submit to USAID and MOPH a report in French.

9. Debrief to USAID/Washington and VBC.

2. Methodology and Study Protocols

The detailed protocols and rationale were presented in the report from the previous consultation (Ratard, Manguin-Gagarine, White 1991). A summary is presented here.

It would have been best to carry out a national study on a representative sample of the population stratified by ecological area and for each of the seasons of transmission. This approach would have been beyond the scope of work and the laboratory capabilities of MOPH. It was decided instead to study a small number of villages in different ecological zones. However, because malaria is not uniformly distributed throughout an ecological zone, a study in a village or two cannot be representative of an entire zone.

To evaluate the ability of the health system to control malaria, two approaches were selected:

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

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

Practical considerations were essential in the selection of sites. Preference was given to sites near the drug-sensitivity sentinel sites, even though these sentinel sites were not functional. The selection of study sites near the sentinel sites was expected to bolster the sentinel sites.

1. In the Sudanian zone, the village of Monboye Tounga and the Tanda dispensary, located some 20 km from Gaya, were selected. The drug-sensitivity sentinel site is located in the Gaya Medical Center. To increase the sample, the village of Alfagaye, farther away from the Nige[illegible]s added.

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

3. In the Saharan zone, the preliminary study was carried out in the Tahoua division at the Tchin Tabaraden dispensary and in the village of Akarana. The insecure conditions prevailing in this area precluded continuation of the preliminary study. The dispensary of Intuila and the neighboring village of Djoura were selected instead. Both are located in the area of Dakoro Medical Center. Although this area is arid, it cannot be considered as belonging to the Saharan zone. No Saharan-zone village could have been surveyed within the constraints of this consultancy.

4. Niamey had to be represented, since the conditions in this city are different from those in the surrounding rural area. The district of Boukoki was selected because there is a dispensary and an MCH Center in the area.

2.1 Study Design

The studies were integrated to give a thorough picture of the situation in each site. The studies were divided into:

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

2.2 Organization of Studies

The studies were carried out by a team from the MOPH including the coordinator for the NMCP, the physician epidemiologist from Division of Study and Planning (DSP), two laboratory technicians for the parasitologic examinations, a team of entomologists from MOPH, several mosquito collectors, and sociology investigators. Also participating in the

studies were staff members in the divisions where the studies took place, particularly laboratory technicians, health education coordinators, and sanitarians.

2.3 Description of Study Sites

Descriptions of the villages of Dagouaje and of Monboye Tounga were presented in the September 1991 report. The Boukoki 2 district of Niamey and the village of Djoura are described below.

2.3.1 Village of Djoura

Djoura has an estimated population of 500, almost exclusively Hausas. The village is divided into three districts, each representing the Hausa subgroups Gobirawa, Adarawa, and Sanguirawa. There are 44 households containing extended families. Half of the heads of household are polygamous.

The village is located in the Sahelo-Saharan zone, 24 km north of Dakoro and 3 km from Intuila village, where there is a rural dispensary. It was founded around 1822 by a hunter named Na Allah. The present chief is the grandson of the founder. Religions practiced are Islam and Bori (animistic cult).

There are two koranic schools providing five to six years of study for boys and two to three years for girls. The primary school is in Intuila, but none of the children attend school there.

During the rainy season, the villagers cultivate millet, sorghum, beans, cotton, and squash. In the dry season, irrigation allows smaller cultivation of products that are sold in Intuila. There is also some herding of sheep, goats, and beef. Animals are herded by Peuls or Bouzous shepherds. There are a few craftsmen and traders in the village. The main social organizations are the Women's Club, the Islamic Association, the Samaria (Youth Association), the Development Council of the village, and a few craftsmen's associations.

The village has two wells, one of which produces only soiled water at a very low output. During the rainy season there are temporary ponds. The crops do not provide food for the villagers year-round. During the dry season, villagers have to buy food from the markets of the surrounding villages.

The population complains of diarrhea, respiratory infections, fever, scabies, miscellaneous pains, and conjunctivitis. Women often suffer from gynecological infections called "kolera" that cause miscarriages, which may be fatal to the mother. There are no latrines in the village. In spite of the food shortages, there is no evidence of malnutrition among the children, probably because the workers who look for employment in other areas send back enough money to support the extended family. There are three marabouts, three herborists, and two female Bori priests. Modern care is available in the village of Intuila, three kilometers away. The villagers walk there or use a donkey cart. There are pharmaceutical stores in Intuila and Dakoro. There are also a lot of Nigerian drugs sold on the markets: vitamins, antibiotics, caffeine, and amphetamines. These drugs are often used to treat malaria. The Village Health Team consists of two village health workers (VHWs) and one midwife trained in 1980 and retrained in 1986. Because of mishandling of monies, there is a continuous shortage of cash.

2.3.2 Boukoki District

Boukoki is a recently created district (1970) located north of downtown Niamey and north of the Niger river. The population is estimated at more than 8,000. All the Niger ethnic groups are found there, but Djermas and Hausas are the most prominent. The majority are migrants from rural areas of Niger. Because there is little cohesion among residents, there is low social stability, no extended families, and high youth delinquency. There are several koranic schools, two primary schools and one kindergarten.

Occupations include traditional roles (marabouts, trader, herdsman, farmer) as well as more modern ones (mechanic, driver, apprentice). The fields cultivated are out of town, in the north at Zarmanga or south of the Niger river. There is a water supply system with numerous easily accessible faucets, and electricity is supplied. The population relies on the market for food supply.

Malaria is one of the health problems of highest concern. There is a dispensary, built in 1982, a MCH clinic, opened in 1988, and an MCH Dispensary, opened in 1990. It appears that the drug supply is not sufficient, and health personnel have to give out prescriptions. There are also a few herborists and marabouts.

3. Results

3.1 Results of Parasitologic Surveys

3.1.1 Plasmodium infections

The parasitologic survey included 892 children, ages 0 to 9. The results are presented in the following table. The average parasite prevalence was about 35%. There were no important differences between villages. The Boukoki district of Niamey had a very low prevalence of 4 percent. Easy access to medical care may explain this low prevalence. *P. falciparum* was the most common species, followed by *P. malariae*.

		Parasitology								Spleens			
		P. falcip		P. malariae		P. ovale		Plasmodium					
Village	Exam	Pos	Prev	Pos	Prev	Pos	Prev	Pos	Prev	Pos	Prev	AES	AS
Monboye	156	60	38.5	7	4.5	1	0.6	62	39.7	20	14.7	1.7	0.22
Alfagaye	100	43	43.0	0	0.0	5	5.0	43	43.0	19	19.0	1.4	0.27
Dagouajé	100	39	39.0	1	2.6	0	0.0	39	39.0	18	18.0	1.7	0.30
Kona	96	57	59.4	0	0.0	3	3.1	58	60.4	15	15.6	1.5	0.23
Djoura	118	48	40.7	6	5.1	0	0.0	51	43.2	29	24.5	1.6	0.41
Intuila	120	51	42.5	1	0.8	0	0.0	52	43.3	12	10.0	1.5	0.15
Boukoki	201	8	4.0	0	0.0	0	0.0	8	4.0	4	2.0	1.0	0.02
Total	892	316	35.4	15	1.7	9	1.0	326	36.5	117	13.1	1.6	0.20

AES = Average Enlarged Spleen, spleen size calculated for enlarged spleens only.
AS = Average spleen, average spleen size, including all spleens.

3.1.2 Distribution of infection by age and gender

The survey focused on children ages zero to nine. There were no significant differences in parasite rates by age group or gender.

3.1.3 Spleen rate

The spleen rate was lower among the very young (zero to two), and stabilized among those from two to nine. The rate of average enlarged spleen followed the same pattern: 1.2 in children less than two and 1.7 among the older children.

Prevalence of malaria infection by age and gender

Location	Age	Male			Female			Total		
		Exam	Pos	Prev	Exam	Pos	Prev	Exam	Pos	Prev
Monboye	0- 1	25	8	32.0	11	3	27.3	36	11	30.6
	2- 4	32	7	21.9	24	14	58.3	56	21	37.5
	5- 9	33	16	48.5	31	14	45.2	64	30	46.9
	Total	90	31	34.4	66	31	47.0	156	62	39.7
Alfagaye	0- 1	6	2	33.3	9	3	33.3	15	5	33.3
	2- 4	21	13	61.9	24	15	62.5	45	28	62.[illegible]
	5- 9	21	12	57.1	19	10	52.6	40	22	55.0
	Total	48	27	56.2	52	28	53.8	100	55	55.0
Dagouajé	0- 1	12	3	25.0	8	5	62.5	20	8	40.0
	2- 4	22	12	54.5	29	11	37.9	51	23	45.1
	5- 9	19	7	36.8	10	1	10.0	29	8	27.6
	Total	53	22	41.5	47	17	36.2	100	39	39.0
Kona	0- 1	10	4	40.0	8	5	62.5	18	9	50.0
	2- 4	24	19	79.2	21	11	50.0	45	30	66.7
	5- 9	11	7	63.6	22	12	54.5	33	19	57.5
	Total	45	30	66.7	51	28	55.9	96	58	60.4
Djoura	0- 1	13	4	30.7	8	1	12.5	21	5	23.8
	2- 4	22	13	59.1	31	13	41.9	53	26	49.0
	5- 9	19	10	52.6	25	11	44.0	44	21	47.7
	Total	54	27	50.0	64	25	39.1	118	52	44.1
Intuila	0- 1	9	5	55.5	13	2	1[illegible].4	22	7	31.8
	2- 4	35	16	45.7	28	8	28.6	63	24	38.1
	5- 9	17	12	70.5	18	9	50.0	35	21	60.0
	Total	61	33	54.1	59	19	32.2	120	52	43.3
Boukoki	5- 9	112	5	4.5	89	3	3.4	201	8	4.0
	Total	112	5	4.5	89	3	3.4	201	8	4.0
Total	0- 1	75	26	34.6	57	19	33.3	132	45	34.1
	2- 4	156	80	51.3	157	72	45.8	313	152	48.6
	5- 9	233	69	29.6	214	60	28.0	447	129	28.8
	Total	464	175	37.7	428	151	35.2	892	326	36.5

Prevalence of enlarged spleen by age

Location	0 - 1				2 - 4				5 - 9				2 - 9			
	Exam	Pos	Prev	AES	Exam	Pos	Prev	AES	Exam	Pos	Prev	AES	Exam	Pos	Prev	AES
Monboye	36	2	5.6	1.5	56	9	16.1	1.4	64	9	14.0	2.0	120	18	15.0	1.7
Alfagaye	15	2	13.3	1.0	45	12	26.7	1.4	35	5	14.2	1.6	85	17	20.0	1.5
Dagouajé	20	0	0.0	---	51	13	25.5	1.7	29	5	17.2	1.1.	80	18	22.5	1.3
Kona	18	2	11.1	1.0	45	9	20.0	1.2	33	4	12.1	1.7	96	15	15.6	1.5
Djoura	21	0	0.0	---	52	15	28.8	1.5	43	14	32.5	1.4	95	29	30.5	1.6
Intuila	22	2	9.1	1.5	63	8	12.7	1.6	35	2	5.7	2.0	98	10	10.2	1.7
Boukoki	--	-	---	---	--	-	---	---	201	4	2.0	1.0	201	4	2.0	1.0
Total	132	8	6.0	1.2	312	66	21.1	1.5	446	43	9.6	1.[illegible]	892	119	13.3	1.5

3.1.4 Parasite density of *P. falciparum*

The parasite density of persons infected with *P. falciparum* in parasites/mm^3 of blood is presented in the following table. The mean densities were low.

Site	0 - 1				2 - 4				5 - 9			
	Ex	Mean	StdD	Mod	Ex	Mean	StdD	Mod	Ex	Mean	StdD	Mod
Monboye	10	8090	23877	200	21	2447	3637	400	29	3193	7722	400
Alfagaye	4	2950	3586	200	28	1821	4403	400	21	1509	2019	200
Dagouajé	8	2150	2492	400	23	1556	3014	200	8	2800	5345	1200
Kona	9	1289	2524	400	29	1041	1016	200	19	784	660	400
Djoura	5	880	576	400	25	1344	1389	200	18	700	563	400
Intuila	6	1400	1485	200	24	1316	1134	400	21	1961	4288	200
Boukoki	-	----	----	---	--	----	----	---	8	375	345	200
Total	42	3197	11691	400	150	1557	2743	400	124	1761	4469	400

3.1.5 Comparison with the rainy-season results

As expected, the prevalences observed during the dry season were lower than those from the rainy season; for example, the prevalences of *P. falciparum* for the rainy and dry seasons were 65 percent and 38 percent in Monboye, and 66 percent and 39 percent in Dagouajé. *P. malariae* followed the same pattern, dropping from 5 percent during the rainy season to 1 percent in the dry season in Monboye and from 17 percent to 1 percent in Dagouajé.

There was also a dry-season decrease in parasite density in Dagouajé, where the mean parasite density ranged from 4,066 to 1,933 Pf/mm^3 and the median from 1,400 to 800. In Monboye there was no apparent decrease in parasite density. These results showed a more important decrease in malaria transmission in villages such as Dagouajé, which lose all breeding places during the dry season, while in villages like Monboye some breeding places persist during the dry season, allowing transmission to continue at a lower scale.

Spleen rates were also lower during the dry season. Since spleen enlargement is a chronic condition, it is expected that changes in transmission conditions would slowly influence the rates. The spleen rates ranged from 49 percent to 15 percent in Monboye and from 53 percent to 15 percent in Dagouajé. The average enlarged spleen rate showed little change.

Village	Parasitology							Spleens			
		P. falcip		P. malariae		P. ovale					
	Exam	Pos	Prev	Pos	Prev	Pos	Prev	Exam	Pos	Prev	AES
Rainy season survey											
Akarana	62	41	66.1	0	0.0	1	1.6	28	11	39.2	1.6
Dagouajé	105	69	65.7	18	17.1	8	7.6	96	51	53.1	1.9
Monboye	91	59	64.8	5	5.5	3	3.3	91	45	49.4	1.5
Total	258	169	65.5	23	8.9	11	4.3	215	107	49.8	1.7

		Parasitology						Spleens			
		P. falcip		P. malariae		P. ovale					
Village	Exam	Pos	Prev	Pos	Prev	Pos	Prev	Exam	Pos	Prev	AES
Dry season survey											
Monboye	156	60	38.5	7	4.5	1	0.6	156	20	14.7	1.7
Alfagaye	100	43	43.0	0	0.0	5	5.0	100	19	19.0	1.4
Dagouajé	100	39	39.0	1	2.6	0	0.0	100	18	18.0	1.7
Kona	96	57	59.4	0	0.0	3	3.1	96	15	15.6	1.5
Djoura	118	48	40.7	6	5.1	0	0.0	118	29	24.5	1.6
Intuila	120	51	42.5	1	0.8	0	0.0	120	12	10.0	1.5
Boukoki	201	8	4.0	0	0.0	0	0.0	201	4	2.0	1.0
Total	892	316	35.4	15	1.7	9	1.0	892	117	13.1	1.6

Comparison of parasite densities according to season

Village	Season	Exam	Mean	StD	Median	Mode
Monboye	rain	59	2993	6590	400	200
Monboye	dry	60	3748	11122	450	400
Dagouajé	rain	69	4066	6121	1400	600
Dagouajé	dry	39	1933	3452	800	400

In summary, there were important seasonal differences in the epidemiology of malaria. The dry-season rates were much lower than those during the rainy season; however, malaria transmission persists in some areas where permanent breeding places are found. Therefore, malaria cannot be eliminated as a possible cause of fever during the dry season without a good understanding of the local situation.

3.1.6 Quality control

A random sample of 60 slides from the September 1991 survey was re-examined for quality control. The rate of false positives (slides counted as positive on initial examination, negative at second and third examination) was 3 percent. These false positives were reported as low densities (200 and 400 parasites/mm^3). The rate of false negatives (slides reported initially as negative and positive on second and third examination) was 5 percent. These were also low-density infections. The rate of discrepancy for parasite identification (number of slides with difference in parasite identification over total number of positive slides) was 8 percent. The most important discrepancies were misidentifications of *P. malariae* and *P. ovale* or missing them in multiple infections with *P. falciparum*.

These results are not surprising. When density of parasites is low, second and third examinations increase the chances of finding low-level infections. The conditions in which slides were collected and examined

were far from ideal. Slide collection took place in a very dusty environment with throngs of people surrounding the sweating technicians, children screaming and stomping their feet, mothers shoving each other, and flies landing on the slides. Slides were examined in the evenings in makeshift laboratories.

Quality control, done as the examinations were made (with microscopists showing results to a second observer, the team malariologist or another technician, as they proceeded), showed that the microscopists were well-trained and carried out their duties with care.

3.2 Knowledge, Attitudes, and Practices (KAP)

The results are presented for the following locations:

- Village of Monboye (MO)
- Rural Dispensary of Tanda (TA)
- Village of Dagouajé (DA)
- Rural dispensary of Kona (KO)
- Village of Djoura (JO)
- Rural dispensary of Intuila (IN)
- Boukoki district of Niamey (BO)

3.2.1 Description of the population sampled

Only people over 12 years old were interviewed. Women were usually more numerous than men, particularly among the patients attending health facilities where mothers accompanied their children. The majority were adults from 25 to 44 years (55 percent of the sample) or younger people aged 12 to 24 (27 percent).

Distribution by age and gender

		MO	TA	DA	KO	JO	IN	BO	Total
12 - 24	M	4	0	5	0	6	0	0	15
	F	12	9	10	2	17	5	22	77
25 - 44	M	10	4	17	6	27	1	4	69
	F	15	5	35	4	20	7	29	115
45 +	M	11	1	9	0	10	0	0	31
	F	7	2	8	0	6	2	3	28
Total	M	25	5	31	6	43	1	4	115
	F	34	16	53	6	43	14	54	220
		59	21	84	12	86	15	58	335

The ethnic group distribution of the sample reflects the distribution in the villages of Djerma and Haoussa in Monboye, and Boukoki, Haoussa in Dagouajé, Kona, and Intuila.

Distribution by ethnic group

	MO	%	TA	%	DA	%	KO	%	JO	%	IN	%	BO	%
Haoussa	15	25	0	0	82	97	11	92	85	99	14	93	19	33
Djerma/Dendi	38	64	20	95	0		1	8	1		1		30	52
Touareg/Bella	5	8	0	0	1	1	0		0		0		0	
Peul	0	0	1	5	0		0		0		0		0	
Other	1	2	0	0	1	1	0		0		0		9	15
Total	59	100	21	100	84	100	12		86		0		58	

In these villages a majority of adults (88 percent) were married. Men usually had a single wife (67 percent) or two wives (27 percent). Farmer (47 percent) and homemaker (47 percent) were the most common occupations. Since it was possible to list more than one occupation for each individual, 56 persons (17 percent) listed two occupations. Often these were women listed as farmers and homemakers.

Distribution according to married status

	MO	%	TA	%	DA	%	KO	%	JO	%	IN	%	BO	%	Total	
Married	49	83	14	67	78	93	12	100	79	92	15	100	49	89	296	89%
Widow	5	8	1	5	4	5	0		3	3	0		0		13	4%
Divorced	1	2	1	5	1	1	0		0		0		2		5	1%
Single	4	7	5	23	1	1	0		4	5	0		4		18	6%
Total	59	100	21	100	84	100	12	100	86	100	15	100	58	100	335	100%
	Number of spouses for married men															
1	13	59	4	80	16	57	6	100	26	68	1	100	2	100	67	
2	6	27	1	20	8	29	0		12	32	0		0		27	
3	3	14	0	0	1	3	0		0		0		0		4	
4	0		0		3	9	0		0		0		0		3	
Tot	22	100	5	100	28	100	6		38		1		2		101	

Distribution by occupation (*)

	MO		TA		DA		KO		JO		IN		BO		Total
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Farmer	14	1	0	4	21	39	1	1	39	37	0	2	0	0	159
Cattle breeder	1	0	0	0	2	1	2	0	5	1	0	0	0	0	12
Fisherman	8	0	1	0	0	0	0	0	0	0	0	0	0	0	9
Craftsman	1	0	0	0	6	0	0	0	3	2	0	0	0	0	12
Civil servant	0	0	3	2	0	0	1	0	0	0	0	0	2	1	9
Business	1	4	0	0	5	0	1	1	6	3	0	2	0	0	23
Homemaker	0	29	0	8	0	23	0	6	0	32	0	11	0	49	158
Jobless	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Other	0	0	1	0	0	0	0	0	4	0	1	0	2	0	8
No. of persons	25	34	5	16	31	53	6	6	43	43	1	14	4	54	335

(*) It is possible for one person to list more than one occupation.

Few of the people interviewed (7 percent) were decision makers. The decision makers interviewed were: chiefs and elders (8); religious leaders (4); marabouts, traditional healers, and village health workers (22); traditional midwives (1); and other (11).

The level of education differed between urban and rural areas. In the urban area 31 percent of the women had received no education at all, while in the rural area a majority of 77 percent had received no education. Too few men were interviewed in the urban area to draw any conclusions. In the rural area 47 percent of the men had received no education at all. Koranic education was the most common form of education: 38 percent of men, 17 percent of rural women, and 31 percent of urban women interviewed received this kind of education. Primary education is rare in the rural areas (1 to 2 percent), and even in urban areas (21 percent among urban females).

Level of education according to gender and residence

School	All M	%	F rural	%	F urban	%
None	54	47	127	77	17	31
Koranic	43	38	28	17	15	28
Primary	10	1	4	2	11	21
Secondary	4	3	2	1	8	15
Other	4	3	3	2	3	6
Total	115	100	164	100	54	100

Of the 335 persons interviewed, 77 percent had traveled out of their village of origin. In general, men had traveled more than females. About 78 percent of the men had traveled in several regions of Niger and had gone to neighboring African countries (mostly Benin and Nigeria). Women usually traveled in the immediate area next to their village of origin (23 percent) or in the neighboring provinces (19 percent).

3.2.2 History of malaria

People were interviewed at health facilities. This sample includes only adults, not children who could not answer questions with reasonable accuracy. Most said that they had had malaria during their lifetimes, except those in Boukoki (Niamey), where one-fourth of the population said they never had malaria. Most said that they had had a bout of malaria during the past year.

Date of last malaria bout

	MO	%	DA	%	JO	%	BO	%
Never	2		4		2		23	27
1 yr +	28	47	30	36	3		6	
1 - 12 months	21	36	37	44	77	89	9	10
Last month	6	10	11	13	3		9	10
Now	2		2		1		11	13
Total	59		84		86		35	

Symptoms experienced

	MO	DA	JO	BO	Total
-Classical symptoms of malaria attack					
Fever	49	66	79	28	222
Headache	6	16	26	4	52
Chills	1	7	3	0	11
Sweats	0	0	0	0	0
Backache, pains	2	17	6	1	26
Fatigue, apathy	0	12	17	4	33
Vomiting	4	2	3	2	11
-Less common symptoms					
Loss of appetite	1	1	0	0	2
Convulsions	0	0	0	3	3
Diarrheas	1	2	1	0	4
Vertigo	1	0	1	1	3
Cold	0	0	1	1	2
Total answers	65	123	137	44	369
Average number of days of					
sick leave	7.1	6.9	5.1	14.0	
spent in bed	2.8	3.1	3.6	1.2	

The majority (60 percent) recognized fever as a major symptom of malaria. Headache (14 percent) and backaches (7 percent) were next. Other symptoms were mentioned much less often. The number of days of sickness was small — from 5 to 15 days depending on location. In spite of the sickness, people went about their daily activities except for a few days.

The type of care provided depended on the location: in Dagouajé, far from a dispensary but with a village health worker available, the majority (75 percent) used the services of the VHW; in Djoura and Monboye, people used self-treatment (49 percent and 54 percent, respectively) or the VHW (23 percent and 47 percent respectively). In Boukoki, where a dispensary was located, the majority used the dispensary (69 percent). The people reported using the most accessible health care provider.

Health care provider	NO	%	DA	%	JO	%	BO	%
No treatment	1		6		10	12	10	29
Self treatment	31	54	10	12	41	49	6	17
Healer	7		5		3		2	
VHW	27	47	61	75	19	23	0	
Dispensary	11	19	5		15	18	24	69
Other	3		1		0		0	
Total	57		81		84		35	
Mean cost FCFA	51		38		42		--	

The average cost of treatment was very low, 40 to 50 F CFA (US$ 0.20). This reflects the low doses administered by health care providers; a good treatment should include five to six times the quantity of drug, which would increase the costs proportionally.

3.2.3 Knowledge and practices regarding malaria

Several questions explored the knowledge of malaria and its causation, mode of transmission, symptoms, treatment, and prevention.

The majority knew malaria and its season of transmission: 267 of the 335 persons interviewed (80 percent) knew that transmission takes place during the rainy season.

Fever was mentioned as the major symptom of malaria by 87 percent. Fatigue, apathy, headaches, backaches, and other pains were also mentioned by 10 percent of interviewees. Other symptoms were more rarely associated with malaria. In summary, the population was well aware of malaria symptoms.

Causation of malaria was not well known; only a fourth of the people (29 percent) knew that mosquitoes transmit malaria. Season, heat, and millet collection were also mentioned as factors in contracting the disease. Most people were aware that mosquitoes were a nuisance, causing pain and itching, but many fewer were aware of their role in disease transmission. About 45 percent said they knew that mosquitoes bred in surface waters.

Malaria symptoms

	MO	TA	DA	KO	JO	IN	BO	Total
-Classical signs of malaria attack								
Fever	53	18	72	9	81	14	45	292
Headache	2	6	9	1	4	1	2	25
Chills	0	3	1	1	1	0	3	9
Sweats	0	2	0	0	0	0	0	2
Backaches, other pains	1	5	7	1	0	1	0	15
Fatigue, apathy	1	0	19	2	7	1	4	34
Vomiting	7	4	3	0	11	3	6	34
-Less common symptoms								
Loss of appetite	1	1	3	0	3	0	1	9
Convulsions	0	0	1	0	2	0	1	4
Diarrheas	1	1	5	1	8	5	2	23
Jaundice	2	1	0	0	0	0	0	3
Cold	3	0	1	0	0	0	2	6
Cries (babies)	1	0	15	1	31	4	1	73
Other	0	1	0	0	0	0	0	1
Total answers	59	21	84	12	86	15	58	335

Causes of malaria	Total	%
No cause	1	1
Mosquitoes	96	29
Season	44	13
Sun, heat	51	15
Millet collect	35	10
Destiny, God	47	14
Other	51	15
Does not know	45	13
Total	335	100

Harm caused by mosquitoes	Total	%
Does not know	23	7
Malaria, fever	77	23
Stings, itches	109	32
Disease	97	29
Other	42	12
Total	335	100

Where mosquitoes breed	Total	%
Does not know	70	21
Water	145	43
Grass	57	17
Garbage	38	11
Houses, walls	83	25
Trees	4	2
Other	7	2
Total	335	100

The survey included several questions about convulsions and abortions, two possible consequences of malaria. A high proportion (25 to 30 percent) did not know of the correlation between malaria and these problems. Preventive actions against abortions are largely unknown.

Causes of convulsions	Nb	%
Does not know	84	25
Malaria, fever	101	30
Mosquitoes	29	9
Season, water, rain	73	22
Sorcerer, spirit	5	1
Fear	18	5
Other	52	16
Total	335	100

Cause of abortions	Nb	%
Does not know	135	40
God, destiny	104	31
Malaria, fever	24	7
Stomach pain, disease	46	14
Heavy work, fatigue	26	8
Drugs, toxics	6	2
Emotions	5	2
Sorcery	3	1
Adultery	9	3
Total	335	100

Prevention of abortions	Nb	%
Does not know	162	48
Chemoprophylaxis	9	3
Avoid mosquitoes	1	1
Traditional treatment	79	23
Prenatal care	45	13
Avoid strains	17	5
Avoid abortive substances	4	1
Other	23	7
Total	335	100

About 50 percent of the people said they knew that insecticide spray could prevent malaria, and they said they knew how to use the spray. Few people said it should be applied as a repellent or used as deodorizer in rooms. Given the costs of the spray, it is rarely used.

To lower fever, 33 percent said they used fresh water or cool wraps (wet wraps) and 31 percent chloroquine tablets, thus confirming that about one-third of the population are well aware of the treatment of malaria.

How to handle fever	Nb	%
No treatment	42	12
Water, cool wrap	112	33
Pills, tablets	105	31
Injections	7	2
Ointments	19	6
Other	30	9
Does not know	23	7
Total	335	100

Prevention of malaria	Nb	%
Nothing	107	32
Prevent mosquito contact	48	14
Magic, plants	82	25
Chloroquine, drug	75	22
Other	12	4
Does not know	22	6
Total	335	100

Prevention of malaria by use of chloroquine and mosquito control were mentioned by 40 percent of the population.

Several questions explored which health care providers are used. The answers depended on the availability of health care in a particular location. In Monboye, served by a VHW and located at some distance from a dispensary, one-third said they used the VHW and one-third the dispensary. In Kona, Tanda, and Intuila, where there are dispensaries, 75 percent said they used the dispensary. An active and respected VHW living in Dagouajé was mentioned as a primary source by 75 percent of the people.

To treat convulsions or abortion, which were less well known by the population, a larger proportion said they used traditional methods and healers.

	Health care providers for malaria								
	MO	TA	DA	KO	JO	IN	BO	Total	%
No treatment	0	1	4	2	8	0	11	26	8
Self-treatment	24	8	8	5	29	3	10	87	26
Healer	5	2	7	3	8	3	2	30	9
VHW	24	1	62	2	20	0	0	109	32
Dispensary	23	16	10	8	22	13	38	130	39
Other	3	0	2	0	4	0	0	9	3
Total	59	21	84	12	86	15	58	335	100

for convulsions	Nb	%
Nothing	7	2
Self-treatment	62	18
Healer	77	23
VHW	18	5
Dispensary	81	24
Scarification	86	26
Other	38	11
Does not know	37	11
Total	335	100

More than half of those interviewed said they knew about the use of mosquito nets. In villages with high densities of mosquitoes (pest mosquitoes mostly), as in Monboye, the majority of the people said they used mosquito nets. Where mosquito nets are used, they seem to be used by the entire family.

Measure against mosquito

	MO	TA	DA	KO	JO	IN	BO	Total	%
Does not know, nothing	2	3	18	1	13	0	9	46	14
Mosquito net	40	12	24	7	57	14	14	168	50
Sleep rolled in net	4	1	4	1	1	0	2	13	4
Sleep under cloth	0	0	0	0	0	0	0	0	0
Eliminate waters	0	2	0	1	0	0	1	4	1
Burn plants	0	0	11	1	2	0	3	17	5
Chinese curlies	4	7	6	0	22	6	2	47	14
Insecticides	1	0	0	0	0	0	10	11	3
Other	4	7	22	5	7	2	18	65	19
Total	59	21	84	12	86	15	58	335	100

Who sleeps under the net

	MO	TA	DA	KO	JO	IN	BO	Total	%
No one	1	2	57	4	26	0	30	120	36
All	58	15	6	2	50	12	19	162	48
Father	0	1	11	3	3	0	0	18	5
Parents	0	2	7	3	1	2	7	22	7
Children	0	1	2	1	6	1	8	19	6
Total	59	21	84	12	86	15	58	335	100

3.2.4 Knowledge score

The knowledge was summarized for each respondent by a single score. Answers used as a basis for the knowledge score were those on malaria causation, convulsion and abortion causation, transmission season of malaria, malaria symptoms, ways to handle fever, mosquito breeding places, harm caused by mosquitoes, prevention of malaria, and treatment of convulsions.

The distribution of scores is presented in the attached figure. It shows a normal distribution with a median of 4, minimum of 0, maximum of 9. The mean is 4.56. Men have greater knowledge than females (4.9 for males, 4.4 for females, significant difference at $p=0.01$). Knowledge is not related to age among either gender. There are differences according to occupation: among males, breeders and fishermen had the lowest scores (3.3 and 4.0), and civil servants had the highest scores. Among females, farmers (3.9) had lower scores than homemakers (4.6). Male traders had low scores, while female traders had high scores (4.5 and 5.9). Decision makers did not have higher scores than others with the exception of VHWs (9.0).

As expected, people with some education had higher scores than the uneducated, but the difference was significant only among females ($p=0.0001$). Experiencing a recent bout of malaria was not associated

with greater knowledge; thus, little is learned from going to the dispensary. This confirms the observation that practitioners spend very little time providing explanations to consultants.

	Knowledge score			
	Males		Females	
	Mean	Std Dev	Mean	Std Dev
12-24 yrs	4.80	1,57	4.09	1.78
25-44 yrs	5.18	1.91	4.59	1.84
45 yrs +	4.38	1.70	4.21	1.87
Educated	4.64	1.51	3.98	1.61
No educ	5.14	2.06	5.11	2.01
Total	4.91	1.84	4.37	1.83

3.2.5 Attitude, causality of diseases

Answers to questions about causation of malaria, convulsions, and abortions can be classified into four categories: malaria or mosquitoes, other natural causes, magical causes, and religious causes.

Type of cause	Malaria		Convulsions		Abortions	
	#	%	#	%	#	%
Malaria, mosq	98	29	126	38	24	7
Other natural	156	46	79	24	78	23
Magic	--	--	36	11	8	3
Religion	46	14	27	8	110	33
Does not know	49	14	77	23	138	41
Total	335	100	335	100	335	100

(*)It is possible to list several causes, the total may equal >335.

Malaria and mosquitoes were recognized by a third of the population, but other natural causes were also often mentioned. Magical and religious causes seemed to have a lesser importance. Therefore, it would seem that a health education effort would be well-accepted and would not go against other accepted notions.

3.2.6 Mortality of children

Since malaria is an important cause of infant and child mortality, it was deemed interesting to evaluate child mortality according to simple questions asked of the parents.

Location	Mean numbers of children born and still alive							
	MO	TA	DA	KO	JO	IN	BO	Total
Married women, young (<30)								
Born	4.1	3.0	3.7	1.0	4.4	2.3	2.9	3.55
Alive	2.7	2.5	2.5	1.0	3.0	2.1	2.5	2.62
% alive	66	83*	67	100*	68	91	86	74
Married women. older (30-49 ans)								
Born	8.5	7.8	6.9	7.2	7.3	7.8	7.3	
Alive	5.2	4.4	3.3	3.7	4.9	5.0	7.1	
% alive	61	56*	47	51*	67	64*	97	
Married men less than 50 years old								
Born	6.6	4.7	7.0	5.0	5.8	7.0	4.5	6.2
Alive	5.5	4.2	3.5	2.3	3.8	3.0	3.0	3.9
% alive	83	89	50	46	66	42*	67	62

Married men (<50 years)	with 1 spouse	with more than 1 spouse
Born	4.7	9.8
Alive	3.1	6.1
% alive	66	62

*Less than 5.

It is important to remember that these data were collected from a questionnaire and are subjective. Older men and women may have forgotten about infants who died soon after birth, and men with numerous wives often lose count of the number of their children. These data do not provide any information on the age at death or on the cause of death. We present in the table the number of children born, the number still alive, and the proportion of children still alive. Parents older than 50 were excluded to limit the data to child mortality.

There were major differences according to locations: In Niamey, the survival rate was the highest (almost 90 percent). The village of Intuila, which has a dispensary and good social organization (water is carried by animals and delivered at homes), had high survival rates. On the other hand, in the village of Dagouajé, where one is struck by the filth of the population and the poor nutritive status of children (in spite of better agricultural opportunities than those further north), the survival rates were very low (less than 50 percent).

The proportion of children still alive was calculated for each female. The mean survival proportion was 0.79 among educated women and only 0.69 among uneducated ones.

Women who had lost no children (proportion =1) had a higher mean knowledge score than the others (4.97 versus 4.15).

3.2.7 Conclusions

The survey results indicate that malaria remains a major public health problem. The low level of knowledge, attitudes, and practices plays an important part.

It is comforting to see that the majority of respondents prefer to use modern forms of malaria treatment rather than traditional means. This does apply to some of the complications of malaria, such as convulsions and miscarriages. The majority either do not understand the role of mosquitoes in malaria transmission, or ignore the importance of water in the maturation of the vector. The link between the rainy season and the presence of mosquitoes does not lead to preventive measures against mosquito proliferation.

One of the major obstacles to be overcome by the health programs, including the malaria control program, is the one-dimensional concept of disease held by the population.

In the traditional concept, disease is harmful because it prevents work. Treatments are directed against symptoms to re-establish the original balance. Thus, water is withheld from a child with diarrhea to bring back the balance. An underfed child is treated to reduce his head size proportionally with his malnourished body. Many traditional treatments have a stimulating effect to allow work to resume. (Such is the case with the drugs coming from Nigeria). This approach is different from the modern medical approach, which prefers to treat the cause of the disease. Traditional medicine does not follow precise dosage schedules. Therefore, the population does not pay much attention to the more precise dose requirements of modern drugs.

This study provided a detailed understanding of the knowledge, attitudes, and practices of the population regarding malaria; this understanding is necessary to plan a health education program.

3.3 Results of the entomologic studies

The entomologic studies were carried out in Niamey and in the three villages selected for epidemiologic studies, but also in the vicinities of these villages.

3.3.1 Monboye Tounga - Gaya

Larval collections

Collections were made at four sites in the village of Monboye Tounga.

Type of habitat	Permanent Temporary	Sun Shade	Density Algae	Density Vegetation	Quality water	Number of larvae Anopheles	Number of larvae Culicines	Larval stages
1-MT, River bank, water hole	P	S	0	1	clear	0	0	--
2-MT, River bank, water hole	P	S	0	0	clear	4	19	L1-2
3-MT, River bank, canoe	T	S	0	1	clear	45	2	L1-4
4-MTD, River bank, water hole	T	S	0	3	clear	12	16	L1-3

0 none, 1 reduced, 2 abundant, 3 very abundant, P permanent, T temporary, S sunny, s some sun, H shade, L1-4 larval stages, P pupae
MT = Monboye Tounga, MTD = Monboye Tounga, Darfo

Larval identification showed only two *An. gambiae* in Monboye Tounga, 27 *An. gambiae*, and 1 *An. rufipes* in Darfo.

Night catch

The detailed results of the night catch are presented in the following table. The average number of bites/man/night (B/MN) was low, with 2.0 for *An. gambiae* and 0.3 B/MN for *An. funestus*. The biting rates by culicines were very low (0.1 B/MN). Refer to Table 3.3.5 on page 29.

Indoor resting collection

	Monboye Tounga			Darfo		
Houses examined	8			2		
Mosquito	M	F	F/house	M	F	F/house
A. gambiae	25	36	4.5	28	14	7.0
A. funestus	0	0	0.0	0	1	0.0
Other Anoph.	0	3	0.4	0	0	0.0
Culicines	58	52	6.5	0	3	1.5

The indoor resting collection was carried out in eight households in the village of Monboye Tounga and in two households in Darfo. The average was 4.5 *An. gambiae* by house in Monboye and 7.0 in Darfo.

Dissection of the midgut and salivary glands of 13 females from the indoor resting collection yielded negative results. The female parous rate was 12/13 = 92 percent.

3.3.2 Dagouajé - Tessaoua

Larval collection

A single site was sampled in Dagouajé, a ditch alongside the well that gets filled when people collect water. Five sites were examined in Tessaoua.

Type of habitat	Permanent Temporary	Sun Shade	Density Algae	Density Vegetation	Quality water	Number of larvae Anopheles	Number of larvae Culicines	Stages observed
1-DA, Ditch along well	P	S	0	0	turbid	0	0	--
1-TE, Brick pond	P	S	3	3	colored	0	10	L1-4P
2-TE, Brick pond	P	S	3	2	colored	23	12	L1-4P
3-TE, Brick pond	P	S	3	2	colored	6	11	L1-4P
4-TE, Brick pond	P	S	3	3	colored	0	44	L1-4P
5-TE, Ditch	T	s	0	0	turbid	0	99	L1-4P

0 none, 1 reduced, 2 abundant, 3 very abundant, P permanent, T temporary, S sunny, s some sun, H shade, L1-4 larval stages, P pupae.
DA = Dagouajé, TE = Tessaoua

Identification of larvae from Tessaoua showed no *An. gambiae*, and all larvae died.

Night catch

In Dagouajé only a few *Aedes*, and no *Anopheles*, were caught biting at night. In Tessaoua two Anopheles were caught during the night.

Indoor resting collection

Houses examined	Dagouajé 2			Tessaoua 2		
Mosquitoes	M	F	F/house	M	F	F/house
A. gambiae	0	0	0.0	2	1	1.0
A. funestus	0	0	0.0	0	1	0.5
Other Anoph.	0	0	0.0	0	0	0.0
Culicines	0	0	0.0	0	5	2.5

Indoor resting collection from two households in Dagouajé yielded no mosquitoes In Tessaoua, the number of mosquitoes was also very small: one *An. gambiae* per house and 2.5 culicines.

Dissection of the midgut and salivary glands of two females from the indoor resting collection yielded negative results. The female parous rate was 2/2=100%.

3.3.3 Dakoro - Intuila - Djoura

Larval collections

A temporary river crosses the village of Intuila; at this time the river is completely dry. After the rains, some temporary ponds will remain for a few months, but for the past four months, they have been dry. Numerous shallow wells have been dug in the riverbed. These wells, about 15 to 30 feet deep, have no mosquito larvae.

In Dakoro the only surface waters are a cistern and a ditch.

Type of habitat	Permanent Temporary	Sun Shade	Density Algae	Density Vegetation	Quality water	Number of larvae Anopheles	Number of larvae Culicines	Larval stages
1-DK, Cistern	T	s	0	0	clear	0	0	---
1-DK, Ditch	T	S	0	0	clear	0	133	L1-4P

0 none, 1 reduced, 2 abundant, 3 very abundant, P permanent, T temporary, S sunny, s some sun, H shade, L1-4 larval stages, P pupae
DK = Dakoro

Night catch

In Intuila, a few *Aedes* were caught, and in Dakoro there were a few *Culex*.

Indoor resting collection

Houses examined	Intuila 2			Djoura 2		
Mosquitoes	M	F	F/house	M	F	F/house
A. gambiae	0	0	0.0	0	0	0.0
A. funestus	0	0	0.0	0	0	0.0
Other Anoph.	0	0	0.0	0	0	0.0
Culicines	0	0	0.0	0	0	0.0

Indoor resting collections in Intuila and Dakoro showed no *Anopheles*.

3.3.4 Niamey

Larval collection

Collections were made at three sites in Yantala 2 and Saga.

Type of habitat	Permanent Temporary	Sun Shade	Density Algae	Density Vegetation	Quality water	Number of larvae Anopheles	Number of larvae Culicines	Larval stages
1-Y2, River bank, water hole	P	S	1	1	clear	32	2	L1-3
2-Y2, River bank, water hole	T	s	0	1	turbid	21	74	L1-4 P
3-S, Rice fields	T	H	0	3	turbid	8	99+	L1-3

0 none, 1 reduced, 2 abundant, 3 very abundant, P permanent, T temporary, S sunny, s some sun, H shade, L1-4 larval stages, P pupae
Y2 = Yantala 2, S = Saga

In spite of the dry season, there were several bodies of water suitable for *Anopheles* larvae.

Identification of larvae from Saga showed five *An. gambiae* (2M, 3F), and in Yantala eight *An. gambiae* (7F,1M).

In Boukoki, where the parasitologic and sociological surveys were carried out, all the ponds were dry except a large man-made pond where irrigation allows the culture of vegetables. In this pond *Anopheles* larvae were found.

Night catch

The average was 8.5 bites of *An. gambiae*/man/night. The bites by culicines were much more numerous (37.5 B/MN). The peak for biting *Anopheles* was in the middle of the night, between 11:00 p.m. and 3:00 a.m. Refer to Table 3.3.5 on page 29.

Indoor resting collection

Houses examined	4		
Mosquitoes	M	F	F/house
A. gambiae	74	55	13.7
A. funestus	0	0	0.0
Other Anoph.	35	13	3.2
Culicines	129	81	20.2

Indoor resting collection from four households showed an average of 13.7 *An. gambiae* per household, no *An. funestus*, and numerous culicines.

Dissection of the midgut and salivary glands of 18 females from the indoor resting collection yielded negative results. The female parous rate was 16/18=89%.

3.3.5 Night catches

Location	Species	Time 06	07	08	09	10	11	12	01	02	03	04	05	06	Total	Homes	Coll	/Coll
Niamey	An.g.	0	0	3	1	2	15	12	12	10	3	5	6		69	4	8	8.6
	An.f.	0	0	0	0	0	0	0	0	0	0	0	0		0	4	8	0.0
	Other An	1	4	4	11	7	5	4	2	1	2	0	1		42	4	8	5.2
	Culicines	1	10	12	21	41	39	23	45	36	27	26	19		300	4	8	37.5
Monboye Tounga & Darfo	An.g.	2	0	1	1	4	3	1	2	4	3	1	3		25	6	12	2.0
	An.f.	0	0	0	0	0	0	1	1	1	1	0	0		4	6	12	0.3
	Other An	0	0	0	0	0	0	1	0	0	0	2	0		3	6	12	0.2
	Culicines	0	1	0	0	0	0	0	0	0	0	0	0		1	6	12	0.1
Tessaoua	An.g.	0	0	0	0	1	0	0	0	0	0	0	0		1	3	6	0.2
	An.f.	0	0	0	0	0	0	0	0	0	0	0	0		0	3	6	0.0
	Other An	0	2	0	0	0	0	0	0	0	0	0	0		2	3	6	0.3
	Culicines	0	0	0	0	1	0	1	0	0	0	0	0		2	3	6	0.3

Homes = Number of households examined, Coll = number of mosquito collectors, /Coll = average number of bites /man /night, An.g. = Anopheles gambiae, An.f. = Anopheles funestus, Other An = Other Anopheles.

3.3.6 Conclusions

The distribution and prevalence of *Anopheles* varied widely according to the season.

In large areas there are no water bodies suitable for *Anopheles* breeding during the dry season. For example, in villages of the Sahelian or Sahelo-Saharan zone, all the temporary ponds created after rainfall dry up, causing *Anopheles* larvae to disappear. During the dry season the only surface waters left are overspill puddles or ditches around the wells. These waters are soiled and constantly disturbed by humans and animals, and therefore unsuitable for *Anopheles* breeding. Indoor resting collections and night catches reflected an absence of *Anopheles*.

The largest ponds are not completely dry but are usually not suitable for *Anopheles*. For example, in Tessaoua there are 13 ponds in the rainy

season, four of which remain throughout the dry season; but only one is suitable for *Anopheles*. Often these residual ponds are so polluted that they are suitable only for culicines. *Anopheles* densities observed under these conditions were very low.

Anopheles are always found on the Niger river banks, but the densities were lower than those observed during the rainy season.

Considering the small population of *Anopheles*, it is not surprising that the majority of females were parous. Sporozoite rates were negative, as would be expected during a period of low transmission.

3.4 Results of Clinical-Epidemiologic Studies

We first discuss the results of this dry-season study, then compare them with those of the rainy season, which were presented in a prior report (Ratard, Manguin-Gagarine, White 1991).

3.4.1 Overall results

Participants in the study numbered 32 at the rural dispensary of Tanda, 13 at the dispensary of Kona, 16 at the rural dispensary of Intuila, and 38 at Boukoki MCH center, for a total of 99 participants.

Location	Examined	Pos	Prevalence Plasmodium
Boukoki	38	11	28.9
Intuila	16	10	62.5
Kona	13	1	7.7
Tanda	32	5	15.6
Total	99	27	27.3

The majority of the cases were examined by nurses (often male nurses); only one was examined by a midwife.

3.4.2 Description of the participant population

Out of 99 participants, 56 percent were males and 43 percent were females. The age distribution was as follows: infants 0 to 1 year, 32 percent; children 2 to 9, 29 percent; adolescents 10 to 19, 16 percent; and adults 23 percent. There were more males among infants and young children (67% of boys, $X2=9.1$ dof=3, $p=0.03$).

School education rates were 9 percent among children 5 to 9, and 12 percent among those 10 to 19. The most common occupations among adults were farmer (18 percent) and homemaker (82 percent). The majority of adults (86 percent) and children (88 percent) were illiterate.

The ethnic distribution depended on the location, as expected.

Loc	Haoussa		Djerma Songaï Dendi		Touareg Bella Bouzou	Peul	Other	Total
Boukoki	14	37%	21	55%	1	1	1	38
Intuila	15	94%	0		1	0	0	16
Kona	13	100%	0		0	0	0	13
Tanda	0		31	97%	0	1	0	32
Total	42		52		2	2	1	99

3.4.3 Origin of participants

The majority of malaria patients came voluntarily, either by themselves or accompanied by a family member; only 4 percent were referred from elsewhere. In general, the participants came from the village where the dispensary was located (84 percent), less often from the surrounding area (13 percent). The delay between attendance at the dispensary and onset of disease varied according to the location, from two days in Boukoki to eight days in Intuila.

The duration of disease depended on the origin of the patient: 2.1 days among patients from the village itself, and 2.7 days for patients from the surrounding area.

3.4.4 Prevalence of malaria

Malaria prevalence by age group and gender was as follows:

	Male			Female			Total		
Age	Exam	Positive	Prev	Exam	Positive	Prev	Exam	Positive	Prev
0- 1	19	6	31.5	13	4	21.4	32	10	31.2
2- 9	22	9	40.9	7	3	42.8	29	12	41.4
10-19	6	0	0.0	10	2	20.0	16	2	12.5
>19	9	1	11.1	13	2	15.4	22	3	13.6
Total	56	16	28.6	43	11	25.6	99	27	27.3

Location	P.falciparum Exam	Positive	Prev	P.malariae Positive	Prev	All Plasmodium Positive	Prev
Boukoki	38	11	28.9	0	0.0	11	28.9
Intuila	16	6	37.5	5	31.2	10	62.5
Kona	13	1	7.7	0	0.0	1	7.7
Tanda	32	5	15.6	0	0.0	5	15.6
Total	99	23	23.2	5	5.1	27	27.3

The prevalence of malaria in this population of patients seeking treatment for fever was 27 percent, while during the rainy season it was 81 percent, a significant difference (RR 3.87, CI 2.67-5.65). Thus, the symptom of fever was four times more likely to be associated with malaria during the rainy season than it was during the dry season.

The high prevalence of *P. malariae* in Intuila is noteworthy. *Plasmodia* other than *P. falciparum* represented a higher proportion of the cases during the dry season than they did during the rainy season.

3.4.5 Symptoms

All the participants complained of fever; such complaints were a prerequisite for participation in the study.

None of the clinical signs showed any significant association with the presence of parasites. However, there was a strong association between the clinical diagnosis of malaria by the health practitioner and the presence of parasites (OR=4.63 p=0.002). Therefore, the clinical skills of the health practitioner are somewhat useful in predicting malaria infection. The fact that not a single symptom or a simple association of symptoms was significantly associated with plasmodial infection shows how difficult it would be to devise a simple algorithm for diagnosis.

	No infection		Infected		OR	Confidence interval	
Headache	50/72	69%	19/27	70%	1.05	0.36-1.35	0.92
Chills	20/72	28%	8/27	30%	1.09	0.37-3.20	0.85
Vomiting	31/72	43%	14/27	52%	1.42	0.54-3.80	0.53
Diarrhea	37/72	51%	13/27	52%	0.88	0.33-2.33	0.77
Sweats	29/72	40%	12/27	44%	1.19	0.44-3.17	0.70
Urinary burn	16/72	22%	3/27	11%	0.44	0.09-1.84	0.21
Back aches	20/72	28%	9/27	33%	1.20	0.63-2.30	0.58
Dyspnea	12/72	17%	6/27	22%	1.32	0.37-4.52	0.62
Cough	20/61	33%	14/26	54%	2.39	0.85-6.81	0.06
Skin infection	1/72	1%	0/27	0%	----	---------	----
Temp >38	41/56	73%	17/25	68%	0.76	0.25-2.46	0.63
Malaria diagnosis	31/72	29%	21/27	78%	4.63	1.51-14.8	0.002

3.4.6 Clinical signs: spleen and temperature

The spleen rate was 9.5 percent among those infected and 14.5 percent among those not infected. To better evaluate the predictive value of an enlarged spleen, it is useful to review the data collected during the parasitologic surveys.

Type of observation	Infection	Examined	Enlarged	Spleen rate	AES
Outpatients	Infected	21	2	9.5	2.5
	no	42	6	14.2	2.7
Rainy season survey	Infected	109	58	53.2	1.8
	no	54	24	44.4	1.7
Dry season survey	Infected	324	82	25.3	1.6
	no	565	34	6.0	1.4

During the rainy season, prevalence of spleen enlargement was high (about 50 percent), and the association with parasite infection was weak. However, during the dry season there was a very definite association between enlarged spleen and infection. This association was not found in the epi-clinical study, probably because of the variability in spleen examinations carried out by a wide variety of practitioners.

The mean temperature of infected individuals was 38.5°, versus 38.4° for the non-infected. Therefore, temperature is not a useful predictor.

3.4.7 Treatment

There was only one pregnant woman in the study, and she did not take chloroquine prophylaxis. Only six individuals had taken chloroquine prior to the visit, and 12 had taken some traditional treatment. These data contrast with those of the sociological study, which showed that a high proportion of people had taken self-treatment and traditional treatment. The practitioners tended to rush into prescribing drugs as soon as the clinical examination was over. They did not spend much time finding out how the patient had managed the fever before attending the clinic, thereby ignoring some very useful information.

A summary of the observations made on the management of malaria is presented in the following table. The data are broken down by health facility in order to show the variability of the management schemes used.

Location Date	Type of malaria treatment prescribed: Chloroquine only		Quinimax only		Chloroq & quinimax				
	1day	3+d	1d	3+d	1d	Q1C3	3d		
Sep 1991									
Boukoki	2	0	1	0	11	0	2	16	
Kona	4	0	5	0	2	0	0	11	
Tanda	0	7	0	0	0	0	0	7	
Tchimbara	0	0	7	3	0	0	0	10	
Total	6	7	13	3	13	0	2	44	
May 1992									
Boukoki	9	3	0	0	6	0	8	26	
Intuila	11	1	0	0	1	0	0	13	
Kona	4	1	3	0	1	0	0	9	
Tanda	1	2	0	0	0	26	0	29	
Total	25	9	3	0	8	26	8	79	
Grand total	31	16	16	3	21	26	10	123	
Diagnosis:									Antibio
Malaria	24	13	16	3	1	8	10	75	0
No malaria	7	4	0	0	0	18	0	29	10

There were very important differences in the treatment regimen used. The only acceptable schemes were chloroquine for three days (only 13 percent of cases), or a combination of chloroquine for three days and injectable quinine (quinimax) for one or more days if the patient was vomiting at the time of the initial visit. So the majority of patients (58 percent) receive inadequate treatment: either a single dose of chloroquine or quinimax without follow up with chloroquine.

Vomiting should be the symptom driving the need to use injectable quinine. The following table shows that 48 percent of the people who did not report vomiting were administered quinimax anyway, and that 24 percent of the people who complained of vomiting still received oral chloroquine. Therefore, vomiting is not a good predictor of the treatment regimen used, even though it should be.

	Vomiting		No vomiting	
Chloroquine only	34	51%	14	24%
Chloroquine + Quinimax IM	26	39%	31	53%
Quinimax only	6	9%	13	22%
Total	66	100%	58	100%

Among the 29 cases out of 114 for whom the practitioner did not think the diagnosis was malaria, 18 received quinimax anyway.

The reasons for this abuse of prescription of injectable quinine are the following:

1. **Single-dose chloroquine**: Practitioners attempt to conserve drugs because they are always in short supply. Often patients are given a start-up dose and are told to go purchase tablets to complete the treatment. However, practitioners seldom take the time to insist on the necessity of continuing treatment.

2. **Quinimax to patients who are not vomiting**: People have easy access to chloroquine, but they take it in doses too low to be effective. When people decide to go to a health facility for malaria treatment, they expect a treatment different from the chloroquine they already took. Practitioners should then take the time to explain that chloroquine, given properly, is efficient, and convince the patient to try chloroquine again. The easy way out for the practitioners is to administer injectable quinine, as expected by the patient. The main problem is not a lack of training or knowledge on the part of the practitioner, but a lack of motivation.

3.4.8 Conclusions

The most important conclusions of the epi-clinical studies are as follows:

1. The practitioners are fairly proficient at diagnosing malaria.
2. A correct diagnosis does not mean a correct treatment will be recommended.
3. Chloroquine is prescribed in insufficient doses.
4. Injectable quinine is overused.
5. Duration of treatment is too short.
6. Practitioners are not taking the time necessary to motivate the patients to comply fully with the prescriptions.

3.5 Training

One of the main objectives of this study was to strengthen the capacity of National Malaria Control Program personnel to study and control malaria. This study was possible thanks to the participation of personnel from NMCP, the School of Public Health, and divisional health personnel. Training was integrated with the activities of this study. The list of personnel who participated in the study and received on-the-job training is presented in the itinerary.

A computerized system was left as an example for data entry and statistical analysis. Three Dbase files were prepared: one each for the parasitologic survey, the KAP survey and the epi-clinical study. The structure of the Dbase files was carefully documented so that they could be duplicated for other studies. The Dbase files were associated with screens for data entry and EpiInfo programs for statistical analysis.

This study shows that personnel from MOPH are capable of carrying out multidisciplinary studies including parasitology, entomology, and sociology. The parasitologists, entomologists, and sociologists have adequate technical skills. The Nigerienne personnel carried out the surveys. The computer system in place at the National Information System (SNIS) is perfectly adequate for handling and analysis of the data collected.

Supplemental studies could easily be carried out at affordable costs if study sites were not too far from Niamey. In a later stage, they could be carried out in more remote areas, after proper training of the health personnel from these areas.

The main impediment is a system that stifles individual initiative.

Annex 1. Study Protocols

Parasitologic Studies

Objective

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

2. Evaluate the seasonal variability of malaria transmission.

Methods

The village or district will be selected so as to have 500 to 1000 inhabitants. The focus is on the age group 0 to 9, which is present in the village most of the time and is of interest in malaria epidemiology. The children will be asked to get together at a central place, and the survey will attempt to reach at least 95% of the children.

The parasitologic survey form includes the following information:

- Name of person
- Name of father
- Age of father
- Spleen size
- Slide number

The spleen will be examined in children age 2 to 9, lying down with their legs folded. The spleen size will be recorded following Hackett classification.

Blood will be collected on a slide and a thick and a thin smear will be prepared. A number will be written with a pencil on the thin smear. The slide should be left to dry in the shade, avoiding contact with flies. Dry slides will be stained with Field stain in the following hours. They will be kept in boxes and examined during the trip.

A team of two microscopists will examine the slides and a third microscopist will collect the blood. Microscopists will examine about 50 slides per day.

The species will be determined by 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 density will be evaluated from the thin smear. In that case the number of parasites will 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 be written in the laboratory book and sent 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 the first reading will be compared. Quality control results will be documented and saved.

Results and interpretation

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

Prevalence of infection will be calculated for the age groups 0 to 1 and 2 to 9. A comparison will be done by gender. Mean parasite densities will be calculated by age group. The spleen rates and average enlarged spleen also will be calculated.

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

Entomologic Surveys

Objectives

1. Determine the species of *Anopheles*, 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 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 survey and in the surrounding area. 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 collection; and
- night catch on human bait.

The field collection information will be recorded on a form for each habitat. The following will be recorded:

- collection number, date and time;
- geographical data: coordinates, altitude, map number, division and name of the village;
- temperature of air and water;

- stage collected: egg, larva (stage 1, 2, 3, 4), pupa, adult;
- type of collection: larval collection, indoor resting collection, night catch on human bait or other bait;
- topography;
- distance to the nearest building;
- height above the soil for adult collection;
- meteorological data on the sky and wind at the time of collection;
- shade on the larval site;
- potential hosts around.
- data on the immediate surroundings and modifications caused by human activities;
- water data: permanent or temporary, movement, salinity, turbidity; and
- phyto-ecologic data: type and density of vegetation, type and density of algae.

A sampling table at the bottom of the form will be used to record the number of *Anopheles* and culicines collected for each collection. Larvae of *Anopheles* and culicines will be evaluated on 30 larvae per site.

At the laboratory

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

The adults will be examined for identification. Part of the living adults will be used to evaluate the parasite infection rate. The stomach wall and salivary glands of each adult will be dissected and observed for oocysts and sporozoites, respectively.

Sociological Studies
(Knowledge, Attitudes and Practices)

Objectives

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

2. Describe the source of medical care of the villagers.

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

Methods

To achieve these objectives, a knowledge, attitudes, and practices (KAP) study will be carried out. This survey will be done in conjunction with the parasitologic and the clinical epidemiology surveys. Questionnaires will be given out in the villages and at health facilities.

The questions are open-ended with precoded answers for the responses expected to be most common.

The survey has 2 components:

1. Knowledge, attitude and practice component at the village

The KAP questionnaire consists of the following:

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

2. Knowledge, attitude and practice component at the health facility

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

Interpretation and results

The KAP questionnaire will be analyzed to describe 1) the KAP regarding malaria in the community and 2) the distribution by ethnic group, age, gender and educational level. A comparison between KAP results from the community itself and the surrounding area will be done to look at possible differences in cultural beliefs.

The KAP questionnaire attempts to determine the knowledge of the population surveyed about malaria (symptoms, treatment, cause and prevention, link between malaria and convulsions and between malaria and miscarriage, the role and reproduction of the vector). The information collected will be useful to 1) define the health education to be done, 2) determine the constraints that cause the population to underutilize the health services and 3) identify 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 votre enfant fait du paludisme, qu'est-ce que vous faites pour le soigner?

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

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 votre 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 2

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 même 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

There are 3 categories of objectives for the clinical studies:

1. Evaluate the practitioners:

   1.1 Evaluate the relevance of diagnosis, treatment, and preventive actions carried out by the practitioners 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 evaluation of the etiology of fevers.

3. Implement a continuing education program.

In this study, objectives 1 and 2 will be implemented.

Methods

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

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

2. anyone suspecting malaria to be the cause of his or her illness, with or without fever.

This study will be carried out in the health facility catering to the population of the community surveyed for the parasitologic study.

The questionnaire *Surveillance of fever cases* includes the following information:

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

Since the main objective is to evaluate the practitioners, questionnaires will be provided, the selection criteria explained and the practitioner will be asked to fill in all the blanks.

First the practitioner will follow the questionnaire as a guide for the patient interview. Then the clinical examination will take place (examination of the main organ systems to look for a specific etiology or for signs of severity, temperature taken, spleen examination, blood collection). The blood will be collected by finger prick following the same procedure as in the parasitologic survey. The practitioner will fill in the examination results, think about the diagnosis and write it down. He then will decide on the treatment, write it down, and communicate his recommendations to the patient.

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

The questionnaires will be evaluated before data is entered. Questionnaires will be evaluated on:

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) and analyzed statistically with EpiInfo. The quality of the information will be evaluated before statistical analysis begins.

Results and interpretations

The results will deal with the following:

- distribution of the population regarding demographic parameters;
- origin of outpatient population not coming from the village;
- severity of symptoms before consultation;
- description of symptoms, a comparison between infected and non-infected to determine ways to improve malaria diagnosis, and calculation of the predictive value of each symptom and combination of symptoms;
- description of physical signs;
- description of spleen enlargement, and its association with infection;
- predictive value of fever and enlarged spleen;
- predictive value of the practitioner diagnosis;
- description of other diagnosis and comparison according to infection status;
- prevalence of previous treatment; and
- description of treatment given and an evaluation of appropriateness of dose and drug selected.

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, Propnylaxie palu 0-Non 1-Oui [ ] Nb comprimés/semaine [ ]

Profession habituelle: 1-Agriculteur 2-Eleveur 3-Pêcheur 4-Artisan 5-Employé 6-Fonctionnaire 7-Commercant 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-presenté lui meme ou accompagné 3-Referre par agent de santé communautaire [ ]

Provenance: 1-Même village 2-Village de region 3-Nomade 4-Autre [ ]

Temps ecoulé depuis début de maladie (jour) [ ] Activités interrompues (jours), 0 si non [ ] Journees passée couche, 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 à respirer	[ ]
Conscience 0-Alerte 1-Léthargique 2-Coma					[ ]
0-Normal 1-Anormal		Pharynx	[ ]	Auscuite	[ ]

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 preventifs donnés 0-Non 1-Oui [ ]

COMMENTAIRES

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

Annex 2. Itinerary

April

2/3 Orientation of Dr. Ratard at VBC in Washington, D.C. Review of the study protocol.

12 Arrival in Niamey of Dr. Ratard from Washington and M. LeMasson from Bobo Dioulasso.

13 Discussion of the scope of work at USAID/Niamey with Nancy Lowenthal, Child Survival Project Officer.

Discussions at MOH/Niamey with Dr. Mounkaila Abdou, Physician Epidemiologist, DEP, and El Hadj Sani Zagui, Coordinator, National Malaria Control Program (NMCP).

Preliminary planning workshop with MOH and USAID personnel to discuss the study protocol. Attending: Nancy Lowenthal, USAID, Dr. Mounkaila Abdou, Physician Epidemiologist, Division of Study and Planning (DSP) MOH, El Hadj Sani Zagui, Coordinator, National Malaria Control Program (NMCP), Mr. Fouta Aboubacar, Entomologist, NMCP, Mlle. Rekia Abdourahamane, Entomologist, National School of Public Health (NSPH), Mr. Mahamane Abdoulaye, Entomology Technician, NMCP, Mr. Boureima Seidou, Parasitologist, NSPH, Mr. Charles Simon, Parasitologist, Division of Epidemiologic Surveillance and Prevention, Mr. Ibrahim Abou, DSP MOH, Mr. Jean Jacques LeMasson, Medical Entomologist, Dr. Raoult Ratard, Physician Epidemiologist.

14/15 Planning workshop with the same group under the direction of Mr. Kadi Koda, Deputy Director, Directorate of Health Facilities (DHF), MOH, Niamey.

Meeting with Dr. Jean François Molez, ORSTOM Entomologist, Centre Muraz of Research on Malaria, Bobo Dioulasso, Burkina Faso, to discuss coordination with this Centre.

Meeting with Dr. Jean Julvez, Physician Epidemiologist, with the French Cooperation, MOH.

April

14/15 Preparating of the survey.

16/20 Entomologic survey in Niamey.

Epi-clinical study at the Maternal and Child Health Dispensary of Boukoki with the participation of Mrs. Ali Absatou, Senior Nurse, and Mrs. Zakoua, Midwife.

Sociologic survey in Boukoki 2 by Ms. Mariam Mamou and Mr. Adamou Moussa, Sanitarians, Health Education Service, Niamey.

21 Trip from Niamey to Gaya.

Visit to the Divisional Health Directorate of Dosso. Participation of Mr. Idi Hassane, Health Education Service.

Visit to the Gaya Medical Center: Dr. Seidou Halgadoubo, Chief Medical Officer. Planning and training workshop for the study in the area of Gaya with the Niamey team and Dr. Seidou Halgadoubo, Chief Medical Officer, Mr. Adamou Tiemongo, Sanitarian, Mr. Mounkaila Karimou, Senior Nurse at the Dispensary of Tanda, and Mrs. Kadi Barkice, Laboratory Technician at the Medical Centre of Gaya.

Meeting of the local study team: Mme. Kadi Barikiri, Laboratory Technician, Mr. Adamou Tiemogo, Sanitarian, and Mr. Souleyman Siddo, Mr. Ide Ramatou et Mme. Lazumar Hadidja, Planning Officers.

Entomologic surveys in Monboye Tounga.

22 Epi-clinical study at the Dispensary of Tanda with Mr. Mounkaila Karimou, Senior Nurse, and Mrs. Kadi Barkice, Laboratory Technician, Gaya Medical Centre.

Parasitologic, sociologic and entomologic surveys in Monboye Tounga.

April

23 Departure of J.J. LeMasson for Niamey.

Continuation of the epi-clinical study at the Dispensary of Tanda.

Continuation of the entomologic and sociologic surveys in Monboye Tounga.

Parasitologic survey in Alfagaye.

24 Trip from Gaya to Dosso. Trip to Niamey to replace tires.

25 Trip from Dosso to Maradi.

26 Arrival of Dr. Mary White Kaba in Niamey.

Trip of Nancy Lowenthal, Dr. Mary White Kaba and Dr. Moukaila Abdou from Niamey to Tessaoua to the team.

Trip from Maradi to Tessaoua.

27 Visit at the Tessaoua Medical Centre: Dr. Siddo Daouda, Chief Medical Officer, Mr. Sale Tourji, Sentinel Post Laboratory Technician, Mr. Yacouba Doulla, Sanitarian.

Meeting of the local study team: Mr. Tourji Saleye, Laboratory Technician, Mr. Yacouba Doulla and Mrs Hadidja Idi Kalla, Sanitarians, and El Haj Abou Abdou Maliki and Mr. Souleyman Moussa, Planning Offciers.

Epi-clinical study at the Dispensary of Kona: Mr Souleiman Didi, Nurse.

Parasitologic and sociologic surveys in Dagouajé.

Entomologic survey in Dagouajé.

28 Continuation of the epi-clinical study at the Dispensary of Kona.

April

28 Parasitologic survey in Kona.

Continuation of the sociologic survey in Dagouajé.

Entomologic survey in Tessaoua.

29 Trip from Tessaoua to Maradi.

Visit to the Divisional Hospital of Maradi: Dr. Kourna, Chief Medical Officer, Divisional Hospital Centre, Dr. Laouel Kader, Chief of Laboratory.

Visit to the Divisional Health Directorate: Mr. Maïnassara, Senior Health Technician, Family Planning Coordinator, Deputy Director.

30 Trip from Maradi to Dakoro.

Visit to Dakoro Medical Centre: Dr. El Haj Oumarou, Chief Medical Officer, Mr. Mamaradiou Abdoubara, Laboratory Technician.

Meeting of the local study team: Mr. Abdoubara Mamaradiou, Laboratory Technician, Mr. Ibrahim Lasbata, Sanitarian, Mr. Nassamou Litto, Social Worker, Mme. Amina Garba, Nurse.

Preliminary visit to the villages of Djoura and Intuila.

May

1 Epi-clinical study at the Dispensary of Intuila: Mr Abdoul Karim Harouna, Nurse.

Parasitologic and sociologic surveys in Djoura.

Entomologic survey in Djoura.

May

2	Continuation of the epi-clinical study at the Dispensary of Intuila.
	Parasitologic survey in Intuila.
	Continuation of the sociologic survey in Djoura.
	Entomologic survey in Intuila.
3	Return of the epi-clinical team to Niamey.
	Continuation of the entomologic survey in Dakoro.
4	Return of the rest of the team to Niamey.
5	Selection of schools and administrative setup for the parasitologic survey in Niamey.
	Visit to the Medical Department of Niamey Commune I: Dr. Yaro Asma, Chief Medical Officer, Mr. Ide Alzuma, Deputy Chief.
	KAP data analysis.
6	Parasitologic survey in Niamey.
7/9	Data analysis.
	Debriefing at MOH.
	Debriefing at USAID/Niamey.
11/13	Preparation of final report.
	Return of Dr. Ratard to Washington and Dr. White to Cotonou.
14	Debriefing at VBC/Washington.