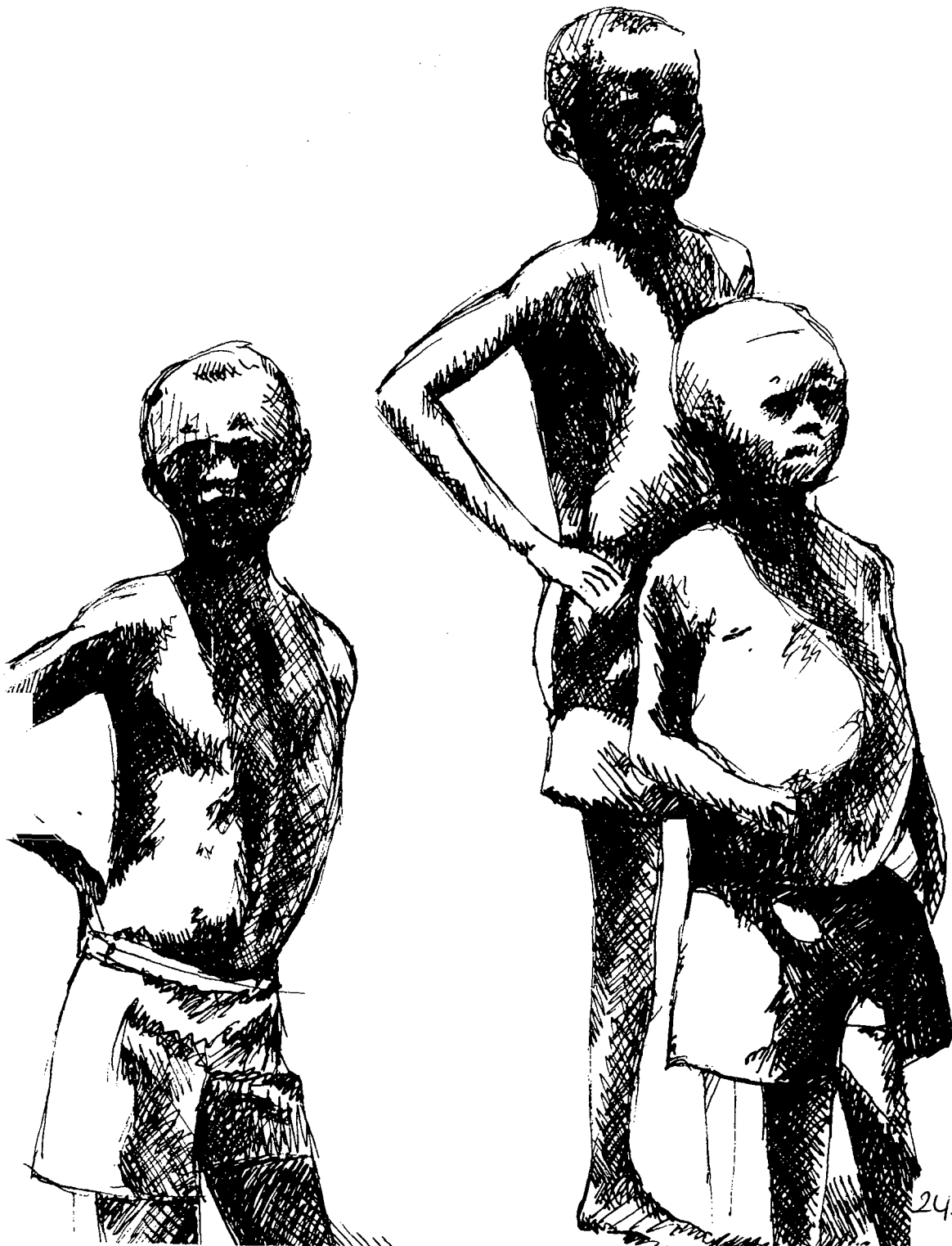

Trans Africa Project REPORT 1988



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Trans-Africa Project 1988

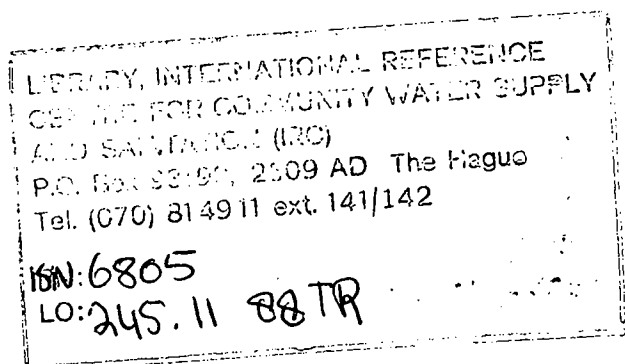
Patrons: Lord Swann

Sir Vincent Wigglesworth

Wilbur Smith

Travelled overland to Kenya from England
carrying out medical and entomological
projects in the Yakusu health zone of
Haut Zaire, August 1988

Julian Knight
Gonville and Caius College,
Cambridge.
CB2 1TA.



Abstract

Trans Africa Project 1988 was an undergraduate expedition from Cambridge University which carried out medical and entomological projects in the Yakusu health zone of Haut Zaire. The expedition consisted of seven undergraduates and travelled overland from England in June using two Land Rover vehicles, continuing on after completion of the projects in Zaire to reach Nairobi, Kenya. One of the Land Rovers was subsequently donated to the Department of Microbiology at the University of Nairobi while the other Land Rover which was on loan from Mann Egerton & Co. Ltd., was shipped back to England.

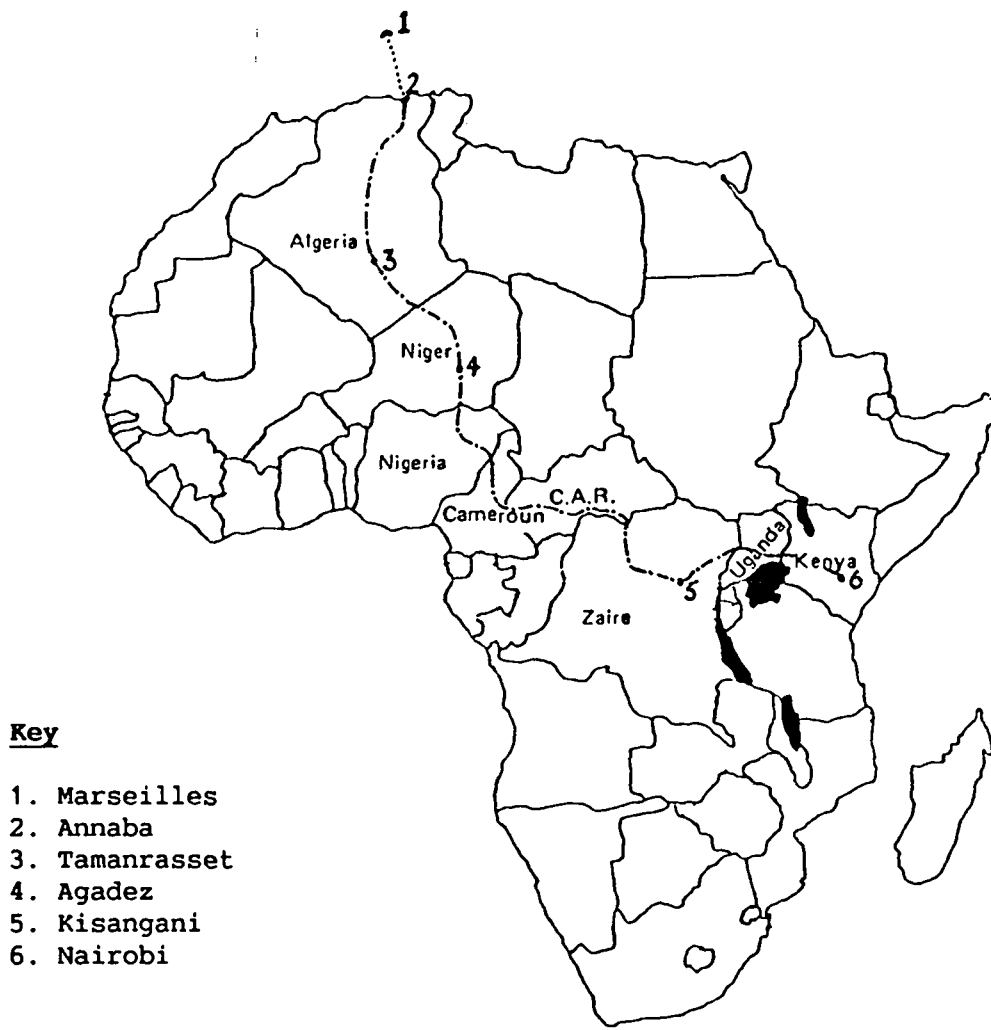
The medical project studied water-related diseases of children under five in two areas which had received differing degrees of health care. The study revealed significant differences between the two areas in terms of various health parameters and indicated that the health care provided by the Baptist Mission Hospital in the first area had been effective. The multifactorial nature of water-related diseases in children was also highlighted, especially the importance of protected water sources and maternal education. The entomological project investigated the host specificity of the cat flea in various domestic animals.

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Key

- 1. Marseilles
- 2. Annaba
- 3. Tamanrasset
- 4. Agadez
- 5. Kisangani
- 6. Nairobi

Sketch map showing route taken

Introduction

The desire to travel to exotic places, to meet and work with the local people and to make a useful contribution to their community are perhaps the ideals of an expedition. Our expedition aimed to carry out scientific projects in a rural community of northern Zaire and to complete the overland journey to Kenya. This was to involve a team of seven undergraduates, two Land Rover vehicles and a massive fundraising effort towards a budget of over £17,000.

The expedition left England on the 23rd June, travelling through France, Algeria, Niger, Cameroon and the Central African Republic to reach Kisangani in Zaire by the end of July. We spent four weeks at the two study sites in the Yakusu health zone carrying out the projects before travelling on through Uganda to reach Nairobi, Kenya on the 13th September. The team returned to England courtesy of British Airways in early October, one of the Land Rovers was donated to the Department of Microbiology in the University of Nairobi and the remaining Land Rover was shipped back to the U.K.

Expedition members

The team was made up of seven undergraduates who were in their second year of study at Cambridge University.

From Gonville & Caius College:

Julian Knight Leader, organiser of scientific projects
Age 20, studying medicine.
Based in Nairobi

Miles Wagstaff Medical Officer
Age 21, studying medicine.
From Norwich

Marian Flinn Treasurer and Catering Officer
Age 20, studying medicine.
From Birmingham

James Arbuthnott Linguist and Field Treasurer
Age 21, studying economics.
From Farnham

Ben Kent Equipment Officer
Age 21, studying history.
From Greenwich

Martyn Emmerson Mechanic (including logistics)
Age 21, studying economics.
From Newcastle-upon-Tyne

From Robinson College:

John Ellis Mechanic
Age 22, studying engineering.
From Norwich

Water related diseases of children in a rural community of Zaire

General objectives

1. To study two communities which had received differing degrees of health care in terms of their domestic water sources, water related cultural behaviour and patterns of domestic water usage
2. To investigate the role of these as determinants of water related diseases of children under five years of age.

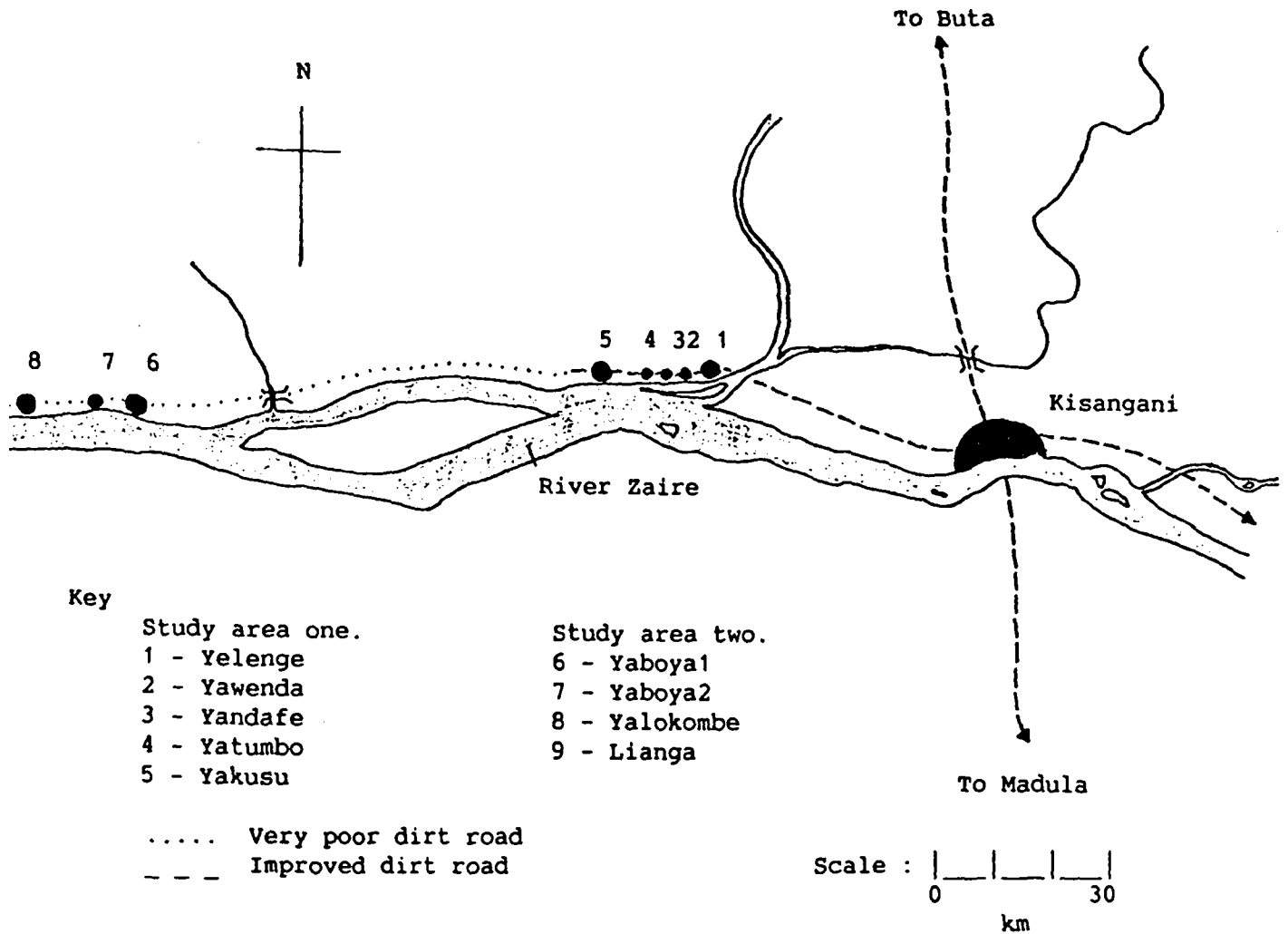
Background information

Inadequate amounts of safe and accessible drinking water, shortages of domestic water, poor sanitation facilities and unhygienic practices are the primary reasons why 80% of all hospital beds in developing countries are occupied by patients suffering from diseases associated with substandard water and sanitation. The problem is perhaps most acute in the under fives where a very large proportion of deaths are thought to be due to these diseases. In recognising this the United Nations has declared the decade of the 1980's as a period for intensive action in the field of water supply and sanitation. Our project aimed to contribute to this by studying two rural communities in Zaire which had received differing degrees of health care.

Our two study areas were in the Yakusu health zone of Haut Zaire, approximately 30 and 70 miles downstream from Kisangani on the river Zaire. The first study area was served by a Baptist Mission hospital which had set up several village based health centres. The second area however had received no health care over the past 25 years.

Specific objectives

- To assess the impact of health care facilities on child morbidity, mortality and maternal health knowledge
- To determine the source, storage and usage of water by a household.
- To investigate the extent and health importance of hygienic behaviour.
- To define the relationship between parental educational achievement and child health care.
- To investigate sources of contamination to water sources.
- To document among children under five, as part of a community survey, the following health parameters:
 1. Acute diarrhoeal disease;
 2. Eye infection;
 3. Roundworm (*Ascaris*) infection, and
 4. The nutritional status (mid-upper arm circumference);and to correlate these with household variables.



Sketch map showing study areas used

Field work itinerary

We arrived at Yakusu Baptist Mission Hospital on the 1st August, after spending six weeks travelling overland from England. On the 3rd August we discussed project execution with the Deputy Inspecteur Regional d'Haut Zaire and were granted permission to carry out their project in two areas of the Yakusu Health Zone. Letters of permission were obtained from the Medecin Chef de Zone for presentation to local chiefs in order to carry out the project in their villages. The purpose of the survey was fully explained to the community at individual villages, and their informed consent obtained through their chiefs.

We organised and trained teachers from the local secondary school to act as interviewers. The questionnaire was pretested and some questions amended as they were inappropriate to the local situation. Research was carried out in the first study area from the 8th to 12th August, we then travelled down the River Zaire by dug-out canoe in order to reach the second study area, approximately 60 miles downstream from Kisangani. From the 16th to 20th August we carried out research in the second study area. A preliminary analysis of data was carried out in the field and a preliminary report prepared for presentation to the Medecin Inspecteur Regional.

Methodology

The project involved doing a community survey of randomly selected households, each containing at least one living child under five years of age, from villages in the two study areas, as well as inspection and sampling of all water sources used by those households. After visiting the local village elders, we made a map of the village showing household positions and water sources. Water sources were later visited, photographed and water samples taken. Interviews were carried out from 3pm onwards, most women having returned to the village from their forest gardens by this time. Local interviewers (either secondary school teachers or equivalent) were trained and used to carry out the questionnaire which we had devised in the U.K. The questions were written in French and translated by the interviewer into Lingala, the local language.

The questionnaire would normally use the mother as interviewee. It was contained on a single A3 sheet and consisted of 36 questions, taking on average 25 minutes to complete. Data recorded included the family's tribe, levels of maternal and paternal education as well as the father's profession. House type, number of rooms and occupants, and the presence/absence of a toilet were also noted as well as maternal parity, the number of living children and the number of children under five years of age. It assessed the household water supply in terms of location, ease of access, amount used, forms of storage and purification; maternal knowledge in relation to water associated disease and hygiene; and maternal and family attitudes towards health and hygiene.

The nutritional status of the eldest child under five in the household was assessed by measurement of the mid-upper arm circumference using a TALC measurement strip, this parameter was used as it is simple and being nearly independent of age (between 1 and 5 years) it does not require child age to be accurately known. This was done by one of the expedition members who accompanied each interviewer. Weight for height measurements were also taken at a second general meeting time in order to validate the arm circumference parameter. Period prevalences of diarrhoea, eye infection and roundworm (*Ascaris*) infection were also recorded for this child; the recall periods being two weeks, three months and six months respectively. A bottled specimen of *Ascaris* was available to be shown to the mother by the interviewer.

The health score was calculated for a given household using a protocol giving a score out of ten on the basis of the mothers responses to questions such as her action when the child has diarrhoea, her knowledge of the causes of diarrhoea, the relative importance of water related diseases, medicines present in the home and her knowledge about them and the number of times she visits the health centre. Credit was given to appropriate health knowledge and actions such as use of sugar and salt solutions for diarrhoea.

Basic data analysis was carried out in the field in order to prepare a preliminary report for the Medecin Inspecteur Regionale, further analysis was done using the SPSS computer program upon our return to the U.K. Samples from the water sources were analysed at the Department of Pathology in the University of Cambridge.

Results

General

The two areas were both comprised of villages running along the banks of the river Zaire (See sketch map). The first area contained the villages of Yelenge, Yawenda, Yandafe, Yatumbo and Yakusu. A good dirt road and a ferry gave access to Kisangani which was approximately 30 miles away. In terms of health facilities there was a Baptist Mission hospital at Yakusu and a newly set up village health centre in Yelenge (as well as existing dispensaries).

The second area contained the villages of Yaboya 1, Yaboya 2, Yalokombe and Lianga. It was served by a very poor dirt road which was impassable while we were there as a bridge was down, necessitating our travel there by dug-out canoe. Only very basic village dispensaries were available.

The two main tribal groups in both the areas we studied were the Turumbu and the Lokele. The former are subsistence farmers using the classical slash and burn type agriculture supplemented by hunting, whereas the latter are primarily fishermen. This describes the male component of the population; in both tribes the women do all domestic work as well as tending vegetable gardens in the forest where crops such as manioc are grown. They till the soil, harvest the crop and then either carry it back to their own homes or into market - which may be a round trip of 40+ miles.

Health parameter data

1. Inter-area comparison

	: Study area one	: Study area two
	: (N = 177)	: (N = 152)
.....
Mid-upper arm circumference :	:	:
a. Below standard (140mm) :	21.3%	36.0%
b. Mean :	(151.39mm)	(145.57mm**)
.....
Mean under five survival rates :	80.09%	76.04%*
.....
Mean incidence of diarrhoea :	25.00%	46.35%**
.....
Mean incidence of eye infection :	30.80%	28.47% NS
.....
Mean incidence of worm infestation :	57.55%	64.23% NS
.....

Using Chi square analysis,

* p= 0.07

** p< 0.001

NS No significant difference

Note: Mid-upper arm circumference values are expressed as the proportion below 140mm. This is the standard based on the 5th percentile for well nourished children given by the National Center for Health Statistics, U.S.A. Hence the normal value for the percentage below 140mm is 5% - the observed values are thus considerably higher.

2. Inter-village comparison

Village	Sample size	Tribe	Survival (%)	Arm circum. (mm)	Dhr (%)	Worm (%)	Health score
Yelenge	46	T	74.3	151.40	41	70	4.5
Yawenda	30	T	82.7	151.13	17	47	3.9
Yandafe	25	T	78.9	151.79	28	60	4.3
Yatumbo	28	L	79.2	149.43	21	68	4.4
Yakusu	46	L	85.4	152.58	15	46	4.1
Yaboya1	45	T	76.3	147.67	51	60	3.8
Yaboya2	33	T	75.9	140.51*	45	36	2.3**
Yalokombe	42	L	80.2	146.38	38	86	3.7
Lianga	32	T	70.2*	146.83	56	66	3.2

Chi squared analysis showed

* $p < 0.05$

** $p < 0.001$

Risk factor data

Village	Sample size	%Def. Soap use	%Covered reservoir	%With a toilet	Health score	Dispensary visits/year
Yelenge	46	63	87	85	4.5	11
Yawenda	30	33	70	77	3.6	3
Yandafe	25	68	88	76	4.2	7
Yatumbo	28	39	93	43	4.4	9
Yakusu	46	85	91	74	4.1	7
Yaboya1	45	67	69	89	3.3	7
Yaboya2	33	55	45	85	2.3	2
Yalokombe	42	43	83	93	3.7	8
Lianga	32	44	69	72	3.1	4

Description of dispensaries, schools etc.

1. Yelenge : A Turumbu village with a primary school and a well stocked dispensary recently set up by the Baptist Mission. This served as the basis for some vaccination programs and very basic microscope work. Some health information seemed to be available e.g. poster displays but unfortunately it seemed the local people made little use of its facilities. The village had a definite "poor end" towards Yakusu.

2. Yawenda : A Turumbu village with a primary school. No dispensary present (used the one at Yelenge)

3. Yandafe : A Turumbu village. No dispensary present (used the one at Yelenge)

4. Yatumbo : A Lokele village. No dispensary present (used the one at Yelenge)

5. Yakusu : A Lokele village adjacent to the Baptist Mission Hospital. The Mission also organised a Secondary school and printing press (and school). The village appeared more affluent than other villages surveyed e.g. number of houses with tin roofs

6. Yaboya 1 : A Turumbu village with a primary school and a poorly equipped dispensary. Some households interviewed used traditional medicine.

7. Yaboya 2. : A Turumbu village with only a very basic dispensary which had no drugs in stock when we visited it. The village was generally poor and use of traditional medicine appeared high
8. Yalokombe : A Lokele village with a primary school and reasonably stocked dispensary. A weekly market was held here.
9. Lianga : A Turumbu village with no dispensary or school.

Water sources

A total of 42 water sources were visited in the two areas. They were invariably small springs in the forest a few minutes walk from the village and a description of them varies from a clear, flowing cemented-in spring to a murky stagnant pool containing a variety of organisms, large and small. Water collection was done by the mother alone in 42% of households, with the elder daughters in 33% of households and by the whole family in 25% of households interviewed. An average household consumed 20 litres of drinking water per day.

Analysis of samples taken from the sources revealed varying degrees of bacterial contamination with some high coliform counts. Unfortunately due to the length of time between collection and analysis and the small samples collected, this data is of limited value.

An interesting relationship was however suggested when the diarrhoeal incidence of children in households using certain sources was considered. It was found that certain sources were associated with very high incidences of diarrhoea whereas for others the converse was true. This is perhaps best shown graphically (see page 9).

Education

Several villages had basic primary schools and a secondary school had been set up in Yakusu. Otherwise students would study during the week in Kisangani. In both study areas there was a clear bias towards educating the sons rather than daughters with a total of only 5% of mothers going onto secondary education, compared to 37% of fathers. We found that 8.6% of mothers in the first area had received secondary education compared to 1.9% in the second.

Highest educational level attained	Fathers (%)	Mothers (%)
None	7	29
Primary	56	66
Secondary	37	5

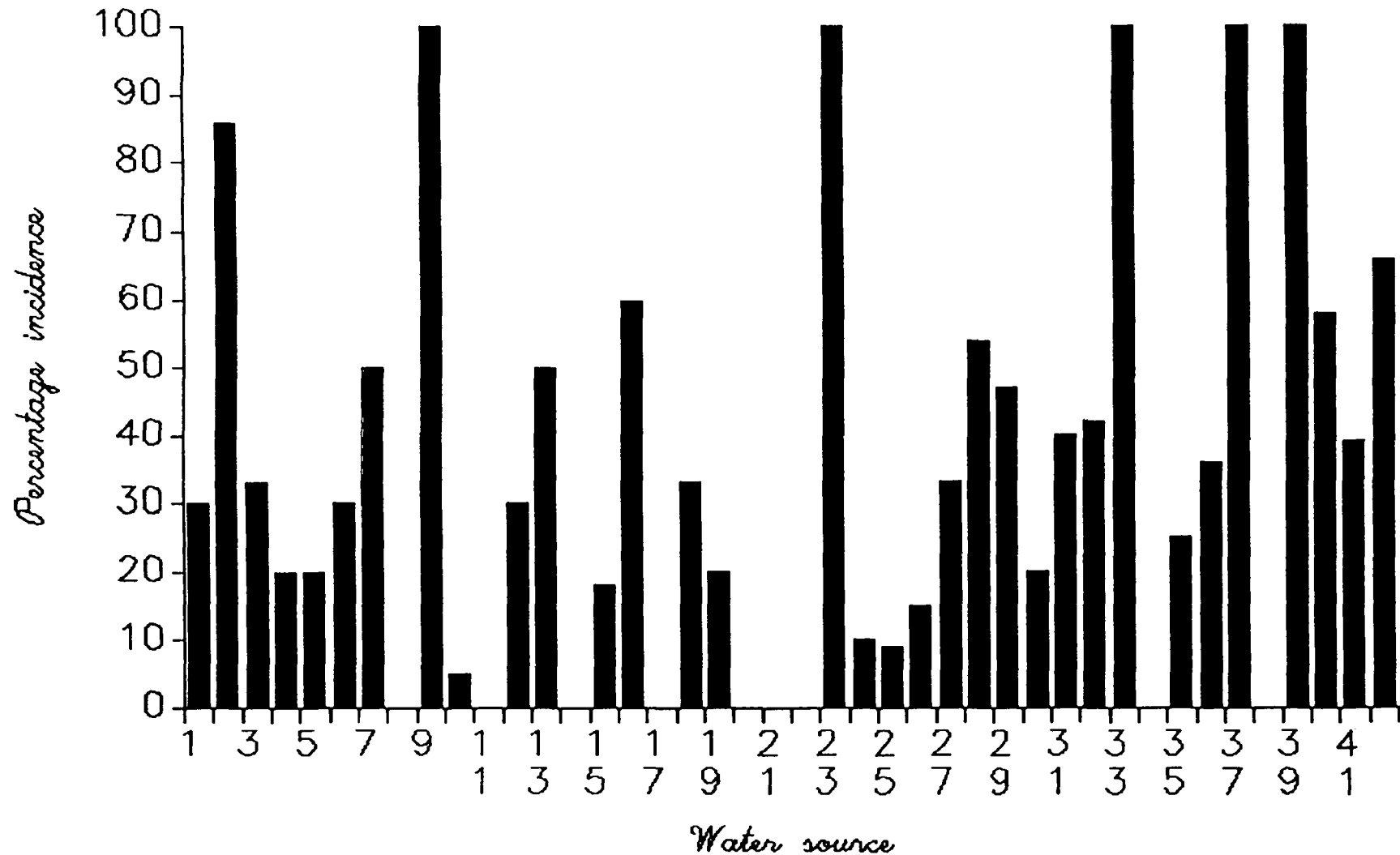
Some interesting relationships appear when maternal and paternal education are considered in relation to:

1. Diarrhoeal incidence - Increased levels of both paternal and maternal educational attainment were found to correlate with a fall in diarrhoeal incidence in the under fives. This result was more significant in relation to maternal education, especially in the second area. (Shown in the graph on page 10).

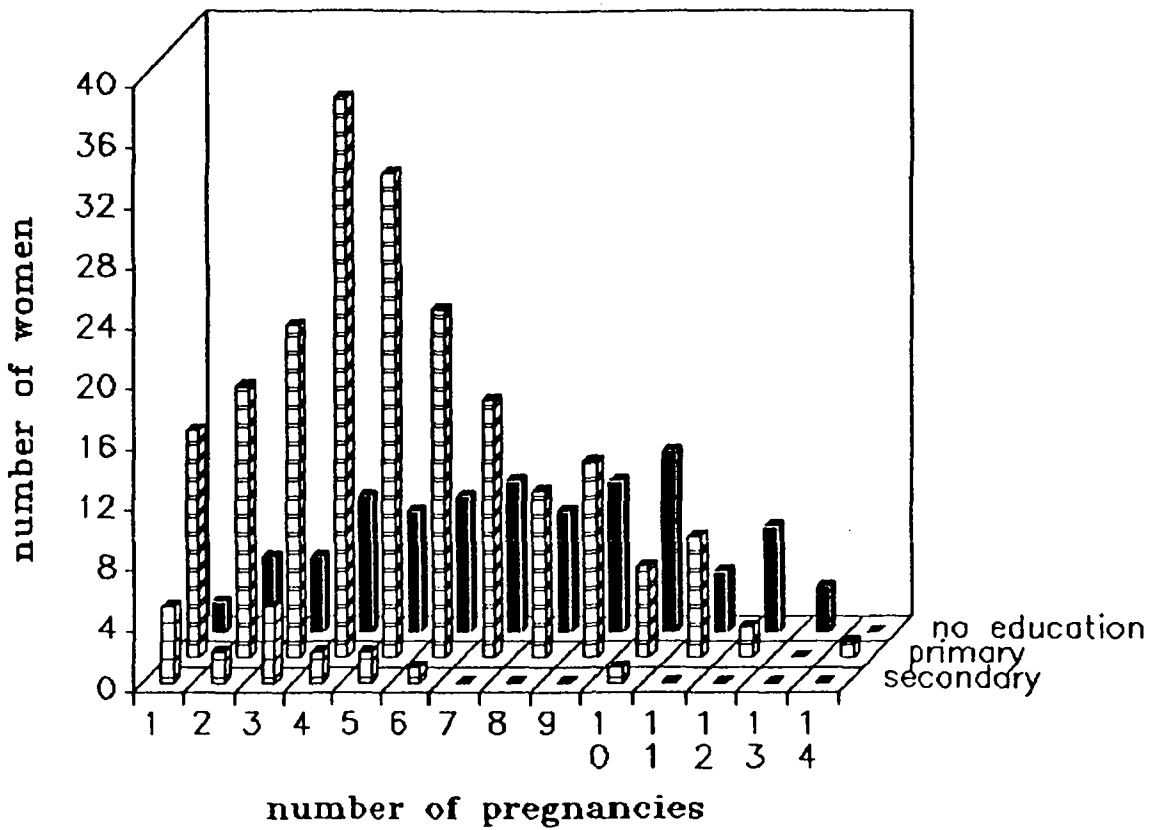
2. Use of a covered water-storage vessel - No correlation was found between paternal education levels and use of covered water reservoirs in the home. For maternal education however, a relationship was found with higher levels of educational attainment correlating with use of covered reservoirs ($p < 0.05$)

3. The number of times a woman becomes pregnant - An inverse relationship seems to exist between level of maternal education and number of pregnancies (Shown in the histogram on page 10).

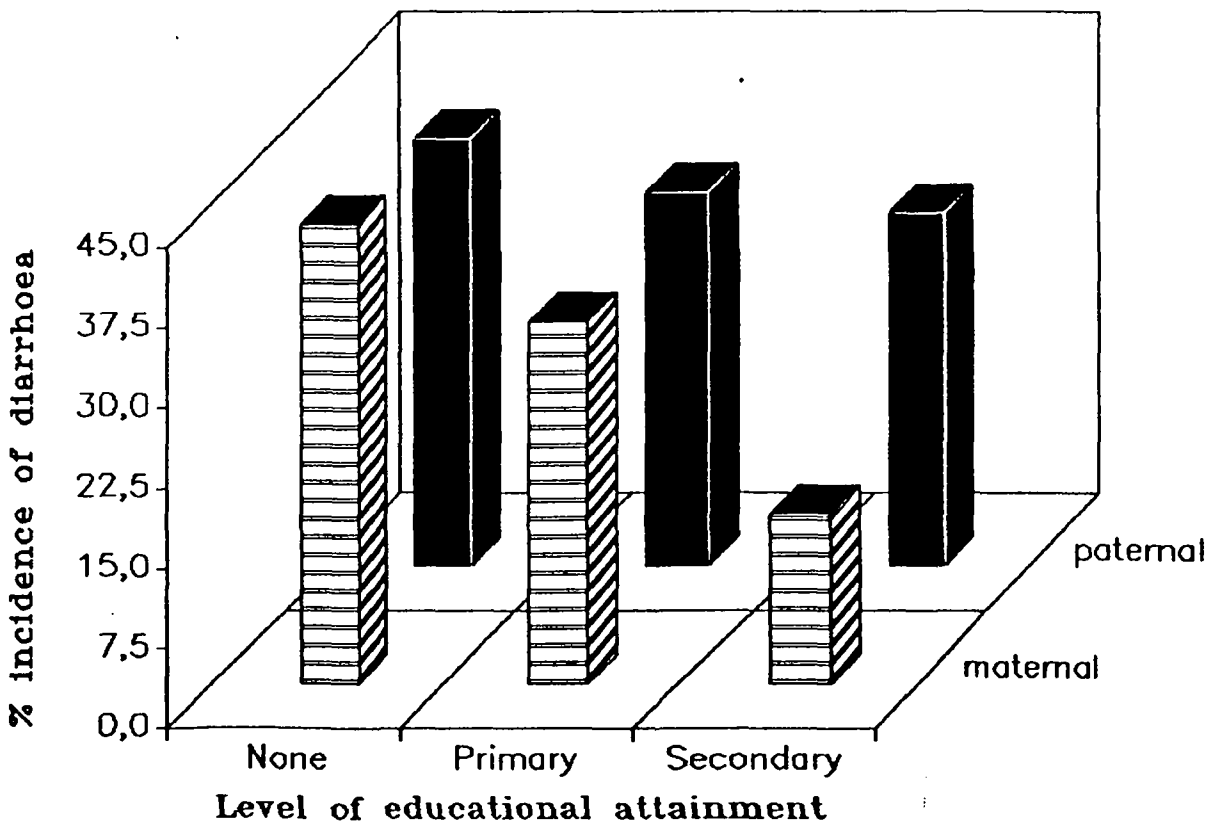
Diarrhoeal incidence in families using each water source



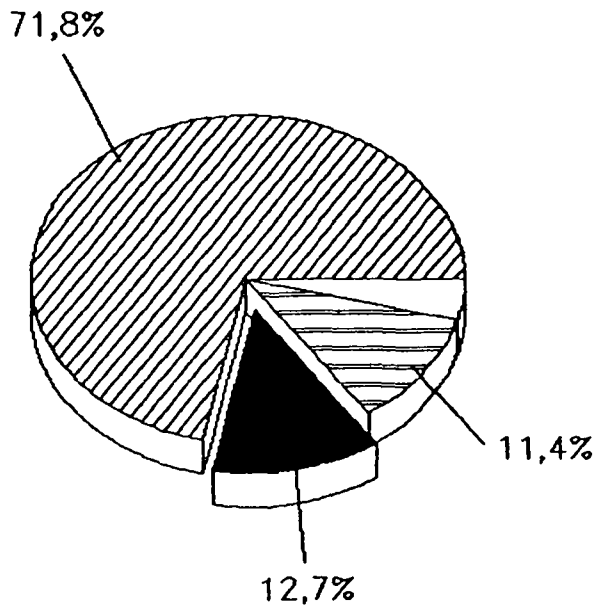
Influence of maternal education on number of pregnancies







Impact of parental education on diarrhoeal incidence in their child

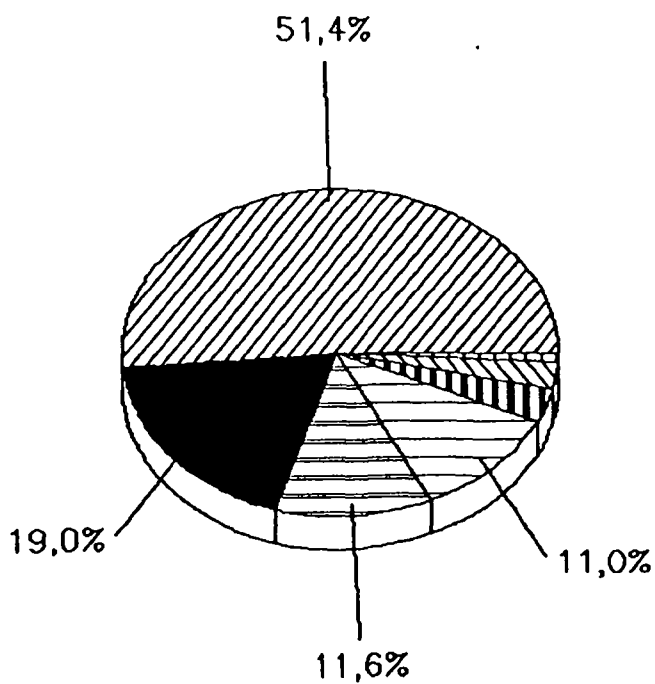









Maternal action when child has diarrhoea



-  to dispensary
-  traditional
-  sugar and salt
-  nothing

Most important diseases of children as described by mothers



-  Measles
-  Malaria
-  Diarrhoea
-  Worms
-  Others
-  Don't know
-  Epilepsy

Boiling water

Very few households said they boiled their water (only 5 out of 329) although some residents of Yakusu said they would boil their water if they had to use the river for drinking water. None of the infants in households claiming to boil their water had any diarrhoea.

Maternal action when child has diarrhoea

This question revealed that 71% of mothers took the child to the dispensary when he/she had diarrhoea. When questioned further as to her action if the dispensary could not help (several of the dispensaries had almost no medicines), a large proportion of mothers described traditional cures. Also, 13% of mothers used traditional remedies rather than go to the dispensary in the first instance. Only 12% of mothers described using sugar and salt solutions or oral rehydration sachets

Medicines in the home, including traditional

When asked about medicines in the home, 68% of households said they had none and 17% said they had some modern drugs e.g. aspirins, anti-malarials. Only 3% of households claimed to know how to prepare a sugar and salt solution or had oral rehydration salts. In 12% of households the mother used traditional medicine - this figure was higher in the second area e.g. 28% of mothers interviewed in Yaboya 2 described traditional cures. Various medicinal leaves were described and their preparation into pastes and solutions for use in curing problems as diverse as fever and broken bones. Other examples include wooden beads worn around the waist as protection against measles.

Discussion

Children in both areas appeared to be generally healthy with few children severely malnourished (as judged by an arm circumference of less than 125mm). However it is important to realise that these are the survivors, our data shows that under five mortality may be atleast 20-24%. Incidence of eye infection was relatively low and for the purpose of the study we felt it best to concentrate on diarrhoeal incidence as our principal health parameter.

The study revealed that the two study areas did differ significantly in terms of health parameters such as mid-upper arm circumference, mean under five mortality rates and diarrhoeal incidence. The reasons for this are no doubt in part due to the impact of improved health care in the first area, but the exact nature of this is difficult to assess. For example, the well stocked "model" health center in Yelenge seems to have had no effect on diarrhoeal incidence in that village, which at 41% is the highest in the first area.

Within the first area a trend among the villages seemed apparent, with increasing distance from the hospital at Yakusu being associated with increased diarrhoeal and worm incidence and a reduced child survival rate. Yakusu was the healthiest village in terms of all health parameters, including child survival rate. The second area had little in the way of effective health care with only one minimally stocked dispensary in Yalokombe. Traditional medicine was far more prevalent in the second area especially in villages such as Yaboya 2 and Lianga. The use of sugar and salt therapy was restricted mainly to the first area.

It is important not to discount the possibility of differences being due to tribal variations. The Turumbu did seem to generally be more "hygienic" than the Lokele e.g. in terms of soap use but mean mortality rates were similar and mean diarrhoeal incidences were 42% in the Turumbu and 24% in the Lokele. Tribal differences may account for the lower diarrhoeal incidence in Yalokombe in area two but even taking this into account, there are significant differences between the two areas.

More instructive perhaps is an examination of factors such as water source, education and maternal knowledge in relation to water associated disease of the under fives. Examination of village water sources revealed a variety of forest springs which differed in apparent cleanliness, speed of flow, and the degree to which they had been improved. There appears to be a relationship between certain sources and diarrhoeal incidence in households using those sources.

The impact of education on child health care was apparent from the results, with both paternal and maternal education being significant in reducing diarrhoeal incidence. The potentially greater importance of maternal education in this regard is unfortunate in a society which gives female education a very low priority.

Maternal knowledge in relation to health and hygiene appeared fairly basic with a low acceptance of simple treatments such as the use of sugar and salt solutions in treatment of diarrhoea. The majority of households used covered storage containers for their water and soap use was high. Almost invariably mothers claimed to wash both their own and their children's hands before eating and after toilet. No relationship was found between either diarrhoeal or worm incidence with regard to factors such as soap use and the possession of a toilet.

Conclusion

The study revealed significant differences between the two areas in terms of various health parameters. It would seem that the health care provided in the first area has been effective, although the study also emphasised the multifactorial nature of water related diseases.

Work done by the mission has therefore been important in improving the community health of the first area but the study also revealed that providing a well equipped health centre such as the one at Yelenge, may not have much effect on health parameters without combination with effective health education. The low acceptance of useful and simple treatments such as use of sugar and salt solutions in both areas and the relatively high use of traditional medicines highlighted this.

With the role of factors such as choice of domestic water source, parental education, maternal health knowledge and hygienic behaviour in relation to water related diseases evident, it is important to consider these factors if any effective control is to be implemented. For example, the importance of protected water sources is emphasised by the association between certain water sources and high diarrhoeal incidence. Identification of these sources and restricting the village to using only one or two sources of maintained cleanliness would seem a sensible precaution. Very few of the sources had been cemented in and an intensification of this scheme is suggested.

The cat flea and its host specificity

General objectives

1. To study the host specificity of the cat flea, *Ctenocephalides felis* in various domestic animals.
2. To investigate their public and veterinary health importance.

Background information

The cat flea, *Ctenocephalides felis*, has recently been found infesting hosts other than its normal host, the cat. Although cat fleas adapt poorly to rodents, they have been found on various domestic animals, some of which act as weak vectors for plague. The flea pays a cost for its catholic tastes in the form of reproductive set-backs when it chooses an unusual host. Should the infestation become heavy enough, this can have serious implications with regard to disease; for example, transmission of Bubonic plague, various veterinary problems including host anaemia and possible death.

Specific objectives

- To record the levels of infestation of *Ctenocephalides* fleas in various domestic animals.
- To determine the reproductive cost of an abnormal host as indicated by the presence of blue-bodies in the flea's reproductive tract (these represent failed eggs).
- To investigate the prevalence and importance of associated health problems: 1. Bubonic plague; 2. Anaemia and loss of appetite in domestic animals.

Methodology

Work was carried out in the same study areas as the medical survey. We had no problems gaining permission to carry out the collection and the local people were more than willing to help.

Collection was carried out by members of the team working in pairs in the village. Having explained what we wanted to do, a suitable animal was chosen and a chase ensued. This often caused great excitement with the hunt paying no regard such obstacles as gardens, fences or indeed people's houses. Once an animal was brought to the ground it was combed, fleas being caught in a bowl of water held alongside. This provided a rough guide to their abundance, for example the number found per five minute combing.

Specimens were taken from each animal where fleas were found and preserved in dubox basil, this required heating the preservative solution for several minutes beforehand using a small solid fuel stove. These specimens were brought back to the Department of Zoology in Cambridge. After sorting, specimens will be mounted in wax and sectioned prior to staining for the presence of blue-bodies (the degenerated nuclei of egg cells left behind in the bases of the flea's ovarioles after developing eggs have been resorbed or passed out of the body).

Results

A total of 41 animals were examined, of which the majority had fleas. These included cats, dogs, goats, pigs, chickens and guinea pigs. Heavy infestations of *Ctenocephalides* fleas were recorded on cats, dogs and goats. Preserved specimens have now been identified and will be sectioned in order to reveal the ovarioles in the near future.

Recent outbreaks of Bubonic plague have been reported in Western Zaire and had occurred in the study area in the past. More serious perhaps from a public health aspect was the very high incidence of head lice throughout the population. This was seen by the mutual head inspections carried out as a matter of course throughout the day. We were fortunate enough to be able to collect several specimens from volunteers.

Conclusion

From the relative abundance of the cat flea on various domestic animals it would indeed appear that the cat flea in Zaire is fairly catholic in its tastes though a final analysis of this must wait until specimens have been fully investigated and assessment can be made of their reproductive success on a given host. The implications of this for disease transmission may be significant, given the relative prevalence of several flea associated diseases. Results will be published as soon as they become available.

This work was supervised by Dr. Bernice Williams who is at the Department of Zoology in the University of Cambridge.

Logistics and administration

Plans for the expedition began in October 1987 with research into the possibility of doing some form of medical project in Africa which would not simply be an extension of ongoing work but would be a useful study in its own right. Not satisfied with this challenge, we also hoped to complete the overland journey to Nairobi. When the complications of developing contacts in the field and gaining permission are added, the prospect becomes quite daunting. A short time span and the huge budget making the expedition a near impossibility.

It is important to realise one's limitations when designing a field project and we felt that taking into account our relative inexperience and the time factors involved, a comparatively non-invasive epidemiological study would be practicable. Given the importance of water related diseases in children under five in the developing world and the current research interest in this field, it was decided to base the project on a community survey using a questionnaire to assess the relative importance of the various risk factors involved.

For any study of this type to be successful it is vital to have good contacts in the field who can advise as to the local conditions and especially how to cope with the bureaucracy of gaining permission to do the work, for without permission the work would be impossible. Gaining permission is likely to take several months and most probably more. We were extremely fortunate in having very helpful contacts at the Yakusu Baptist Mission who made contact with the regional medical inspector on our behalf and we were thus able to secure his go-ahead before the expedition departed. Finding such contacts again requires a combination of a lot of effort and no small amount of luck.

Diplomatic clearance is difficult enough on an overland expedition without the complications of carrying out a medical project. Perhaps most important was to get the Carnet de Passages for our vehicles - this is a Customs document allowing you to temporarily import a vehicle into a country without incurring custom duties. To obtain it required an indemnity of over £55,000; a vast amount that we had to secure by means of insurance arranged by Campbell Irvine & Co. Ltd. The final cost of this was nearly two thousand pounds, something difficult to budget for in the early stages of planning.

Other than this we had to contact the embassies of countries we were to visit, obtain visas for Nigeria, Cameroon, the Central African Republic and Zaire, as well as contact the relevant British embassies. Obtaining visas is complicated by the fact that several of them are only valid for three months and often a visa will not be granted until the one for the country you are transiting to has been secured. Finally, it appears to be common practice to forget to mention all the required documents on the letter sent out with application forms so the whole process can be very time consuming. Planning and patience are definitely required, mind you if you think officialdom in the U.K. sounds complex, try it in Africa.

The team was selected in November and worked hard to quickly produce an expedition brochure on which our fundraising effort was based. We were fortunate in having support from Mann Egerton & Co. Ltd. from an early stage and had secured sponsorship from British Airways, in the form of free flights back from Nairobi, soon after Christmas. Publicity is very important to any form of fundraising and the members of the team all had articles in their respective local papers over Christmas. This effort continued with articles in regional papers, interviews on several local radio stations and an appearance on the About Anglia television programme.

Funding came from both large and small companies, individuals, trusts, scientific institutions and fundraising events such as having the Land Rover on display in the Metro Centre at Gateshead, an expedition raffle and sale of expedition T-shirts and sweatshirts. Considerable amounts of equipment as well as money were donated and we are very grateful to all our sponsors who are listed later in the report.

The team went on a training weekend during the Easter holidays and met regularly during the pre-departure preparations. We also spent a day at the Land Rover test tracks at Solihull enabling us to gain some experience of driving in off-road conditions.

Financial report

Income

Donations	5150
Grants & Scholarships	4730
British Airways (in kind)	
Sale of equipment	2000
Fund Raising	258
Personal	4900

£17,038

Expenditure

Field expenditure	3300
109 repairs/spares	2350
Carnets	1925
109 LandRover	1650
Freighting costs	1450
Insurance (Vehicle)	1335
(Medical)	630
Mediterranean Ferry	1020
Mechanical	680
General equipment	645
Administration	520
Visas	475
Report	470
Catering	250
Film	200

£16,900

In addition, 3 members of the team contributed a total of £1500 to be used as contingency money, in case of any emergencies or overexpenditure during the trip.

Finance on the road

In order to make things as simple as possible there was one team kitty which was kept in a cash box in a locked compartment under a front seat. James was in control of the single team wallet, a fine piece of Ghanaian leatherwork which ended the trip in atrocious condition after James was thrown into the Zaire river. We started off with £4800, divided into 3 currencies: £900 sterling, \$5000 US and FF10000 French Francs. Of this, £1500 was reserve money, held in £ & \$ Travellers' Cheques, which we hoped not to use and, in fact, did not. The provisional expenditure estimate was £ 250/week and final expenditure was as detailed overleaf.

Journey expenditure

Living expenses	1670
Diesel	580
Customs/Insurance	280
Accommodation	210
Project Admin.	100
Repairs/Spares	100
Miscellaneous	160

	£3100

The major surprise was the price of fuel: we had been led to believe that diesel was quite difficult to find in certain places (particularly in Zaire) and that prices could be very high. However we were never remotely in danger of running out of fuel and prices never exceeded 55p/litre (CAR) and were as low as 7p and 9p/litre (in Nigeria & Algeria respectively).

Food was relatively expensive until we reached Nigeria, but this did not affect us much as we had large quantities of tinned and dehydrated supplies (most of which had been kindly donated by companies) to eat. We found Zaire to be a cheap place to live, spending only £800 during our 6 weeks there. This was just as well as we had been trying to make up for a very expensive stay in Algeria, as a result of the compulsory exchange control that operates there. We were forced to change £740 on entry and simply couldn't find anything to spend it on - even completely filling up with fuel only cost £40! We left the country with nearly 3000 Dinars (value at official rate £300, but actual value £60?) and hope to be able to change them at a Swiss bank one day! The other country with strict exchange controls is Uganda, where you are expected to change £120 EACH for a stay of just 3 days! We were very fortunate in that our currency form wasn't scrutinised on exit, but we'd prepared an excellent forgery just in case.

Travelling through countries at a fast rate tends to eat away at the budget quickly. This is mostly due to the cost of crossing borders. Customs taxes (official or not), compulsory insurance, road tax and just ordinary fines (£60 worth) make travelling expensive. In Nigeria, due to the supposed invalidity of the Carnets, we had to pay for a Customs Officer to travel with us for 3 days and fly him back to his original post at a cost of £50! Accommodation costs can also mount up, especially in Niger where you have to spend the night at a recognized official hotel or campsite (average cost £20/night). However we aimed to pitch our tents off the road at all other times if outside towns.

During the project we paid our helpers (teachers/nurses/canoists) a total of £30 and £45 for the 1st and 2nd weeks respectively and on leaving we left a donation of £20 to the Yakusu Hospital Poor Fund. As for the vehicles, we spent £30 on welding (our 2nd repair in Uganda only cost a polaroid camera when £100 was wanted!) and £70 on spare parts. We had not expected to spend much on these as we carried so many spares.

We were able to sell the equipment and spares in Kenya after a lot of phone calls thanks to Julian's mother and this meant that we were able to pay shipping costs for Mann Egerton's Land Rover (£1450) out of the money we received for these.

Mechanical report

The expedition travelled in two diesel Land Rovers, one of which was a 109 3-Series Land Rover and the other a 110. The latter belonged to Mann Egerton & Co. Ltd. and was loaned to us for the purposes of the expedition while the 109 was purchased second hand by the expedition. The 109 kept up well with the 110, the only real difference being more power and a comfortable ride (coil springs).

Final repairs and modifications were carried out in the last few weeks before departure, Mann Egerton helping out enormously. The expedition mechanics, John and Martyn, were able to assist in the work at their Land Rover Centre in Norwich, enabling them to gain invaluable experience. Both John and Martyn had some experience from working on their own cars, in addition John spent a week at the Army School of Mechanical Engineering, where he was taught more about 110 mechanics and diesel engines.

In the appendix we list tools, spares oils etc which we would recommend further expeditions take with them. Sponsors helped with the cost: Mann Egerton (spares on use or return basis and workshop facilities); Landrover (£500 worth of spares plus driver training course); Castrol (£100 and oils); Buck and Hickman (£300 worth of tools). There is also a short list of recommended repairs and modifications which were carried out.

Mechanical problems

1. A total of eight punctures, all on the 109 which had some cheaper tyres - Michelin XZY may be expensive but they are worth it. We had none on the 110, which had light truck tyres.

2. The 109 clutch master cylinder linkage had worn which meant that the clutch would not completely engage, thus causing problems when changing gears, especially from 2nd to 1st. Double de-clutching helped, but eventually, we had to devise a more permanent solution, involving splitting washers and forcing them onto the piston for adjustment.

3. Corrosion on the 109 caused a few difficulties. The chassis had thus been weakened and cracked in several places but we managed to get it welded twice. The second time, in Uganda, was essential because the point on the chassis which holds the front spring (front bumper) had cracked severely after a rock had pushed the spring forward. The bumper ended up at about five degrees to horizontal, and as we drove the crack became bigger (Ugandan roads not helping). Luckily we found a flour mill which had an arc welder, and they repaired it for us. Cost: one tin of corned beef, a Polaroid camera (which had been donated to us) and one 35mm film! Corrosion also caused the breakage of a window frame, bonnet catch, handbrake pivot pin and overdrive linkage. Araldite, self-tappers, sheet steel (number plate bracket) and a steel rod accompanied by a comprehensive toolkit all helped to overcome these minor problems.

4. The swivel-hub oil seals, replaced before we left, became twisted causing oil to leak from the hub. We had no spares but managed to twist the seal around so the kink was at the top, stopping the leak effectively.

5. The 110 pan-hard bushes wore by the time we reached Kenya, the severe vibration at higher speed causing a track rod end to wear down severely. We were able to get replacements in Nairobi.

6. In the desert the 110 fan belt broke and speedometer cables broke in both vehicles (it's worth carrying spare speedometer cables). Other problems included glow plug failure (you can however short out the failed plug and still get cold start) and dust causing the door locks to seize. By the way 'cool' in the Sahara means 'NORMAL' on the vehicle's temperature gauge!

Although we had very few major problems, many people we met on the way had had tremendous difficulties including two rear half shafts breaking within 10 miles, shock absorber bushes wearing completely, clutch slave cylinder seals leaking onto the clutch plate causing clutch failure and battery failure. We heard stories of people welding with a set of jump leads and a battery, stuffing tyres full of grass because they had no means to repair a puncture and so on. Ability to improvise, and make use of what is available is the key to a good expedition mechanic.

Useful things we might have wished we had at the time include 1. Clutch master and slave cylinder repair kits; 2. Brake cylinder seal kit (we had replaced all wheel cylinders, so did not take this with us); 3. Spare glow plugs; 4. Set of track rod ends; 5. Pan-hard bushes (perhaps); and 6. Good hydraulic bottle jack - Hi-Lift jacks are very dangerous in certain situations e.g. jacking up back

Maintenance

En route maintenance consisted of daily level and tyre pressure checks. Leaks could be spotted by looking where the vehicle had been standing, and the underbody was checked for any obvious knocks and so on.

After a long period of rough driving a more detailed check would take place, in particular the brake drums and brake shoes were cleaned after driving through muddy water. This was essential to extend brake shoe life - the 109 brakes needed adjustment very soon after wading for any length of time. We also found that spring hanger and prop shaft bolts would need tightening after corrugations and rough terrain.

Careful driving was critical to reducing mechanical problems e.g. only have your foot on the clutch if you are changing gear, even the slightest pressure can cause wear; driving slowly and taking care of overtaking local drivers; and wading when unsure about the depth of water (don't forget your wading plugs).

Conclusions

Thanks to competent pre-departure preparation and maintenance as well as no small amount of luck, we experienced very few mechanical problems. Thanks to the help of Mann Egerton the 109 Land Rover was very thoroughly serviced and extensively repaired - costing well over £2,000. Problems never seemed to cease to develop, for example the starter motor went on the day of departure, which meant it being fixed hurriedly in the workshop, whilst outside we were having the press photo-call on the forecourt!

Good preparation was fundamental: of both vehicles and drivers. We are very grateful to Land Rover for the opportunity to learn about some off-road driving techniques at their test tracks at Solihull. Even with this experience, though, we never ceased to be amazed at what a Landrover will actually cope with, or at how bad the 'roads' really are - some of the holes we came across were as big as the lorries stuck in them!!

Choice of vehicles is important, and we would recommend when looking at prospective vehicles to note particularly the condition of the chassis, the rear suspension and the engine. The 110 is certainly the better Landrover, but 109 spares are more easily available. Diesel is definitely the best to go for in terms of running costs (we paid 50p per gallon on average), simplicity (no engine electrics to worry about), and safety. We met three English people who had an explosion caused by sliding a leaking petrol jerrycan along the floor of their Land Rover, the friction causing the vapourised fuel to ignite. Luckily they survived unscathed.

Overall conclusion

The expedition arrived safely in Nairobi in September having spent a month in Zaire carrying out proposed field projects. It was thus successful in completing the two main aims of the expedition which were to carry out useful scientific research in a community in Africa and to complete the overland journey from England to Kenya. We were then able to donate the Land Rover we had bought to the Department of Microbiology at the University of Nairobi for use on field projects.

The medical study had been a great success thanks to the enthusiasm and help we found on our arrival at Kisangani. We were fortunate in having excellent contacts in the field in the form of Drs. Bulkely & Burnett of the Baptist Mission Hospital at Yakusu who advised us both before and during our study and proved indispensable in gaining permission to do the work.

We found significant differences between the two areas we studied, reinforcing the importance of work done by the Mission Hospital at Yakusu. The study also revealed the multifactorial nature of water related diseases in children and highlighted the roles of the water source, parental education, maternal health knowledge and hygienic behaviour.

The work on the cat flea proved fascinating to the local people as well as to us. We were able to sample from over forty domestic animals including cats, dogs, goats, pigs and chickens. The importance of host specificity and reproductive success is rapidly becoming realised and the specimens we collected will be very useful to workers in this field.

The Land Rovers coped remarkably well given the conditions experienced and credit for this must go to our mechanics and especially to Mann Egerton for the excellent preparation of the vehicles before we left. Despite the long enforced periods of each others company, humour and good sense prevailed and we all remain good friends. Perhaps this fact above all is the best indication of what was an extremely successful expedition.

Acknowledgements

We would like to thank all our sponsors, whose names appear in the appendix, and all those who have helped us both before, during and after the expedition. It is not possible to mention everyone who has been involved in giving us advice and assistance but in the appendix we have mentioned a few individuals who we would like to especially thank.

Thank you all, it would not have been possible without you.

Appendix

Sponsorship received

Personal contributions

TOTAL £4900

Fund raising

T-shirts & Sweat shirts £80
Earring sale £53
Raffle £124

Donations

Mann Egerton & Co. Ltd. £1000
ICI £750
Land Rover £500
Wilbur Smith £500
BAT Industries(UK) Ltd. £250
C.B.Maudesley £250
Trafalgar House £200
Baddeley Brothers (London) Ltd. £150
Elmwood Church Sunday School £115
Kent Blaxill & Co. Ltd. £100
Hugh Wilson Typesetting £100
Tarmac Construction Ltd. £100
Castrol £100
R.W.Unwin & Co. Ltd. £100
D.Eddy £100
Nigel Farquharson Agencies £100
Reckitt & Coleman £100
M.N.Emmerson £100
Elmwood Church £56
Lex Garages £50
M.W.Brown £50
Greenwich Building Society £50
C.E.Judd £50
E.Harrison £50
R.Ramage £50
A.Kent £30
C.Knight £25
R.Lewis £25
B.Wright £20
C.Lord £15
Premiere Polish Co. £15
M.O.Wilson £10
K.Pittom £10
10th Birmingham Girls Brigade £10
Semat Technical(UK) Ltd £10
Cupal Ltd £10

Grants, Scholarships

Paton-Taylor Travel Scholarships	£1080
Jowett Fund	£750
Handson Bequest	£400
Royal Entomological Society	£300
Balfoure-Brown Fund	£300
The Wellcome Foundation	£250
Mary Euphrasia Mosely Fund	£250
Blue Coat Brotherly Society	£200
Eltham College	£200
Biochemistry Department	£200
Marlborough College	£200
Thompson Charitable Trust	£200
REME Benevolent Fund	£150
Westcroft Trust	£150
Rev. D.J.Streeter Charitable Settlement	£100

TOTAL £15038

Equipment

Mann Egerton & Co. Ltd.	Loan of one Land Rover
Land Rover Ltd.	Use/Return of spare parts
British Steel	30 fuel & water jerry cans
BRS Southern Ltd.	100 gallons diesel fuel
Polaroid Ltd.	Polaroid camera and film
Baddeley Brothers	Envelopes
Sussex T-shirt Company	12 Sweat shirts, 18 T-shirts
Camping Gaz	2 cool boxes
Addis Ltd.	2 Washing-up bowls
Supreme Plastics	Resealable plastic bags
Swan Housewares Ltd.	2 Frying pans
Antiference Ltd.	Plates, bowls, cutlery & storage jars
Gerber Foods International Ltd.	Tinned fruit
British Sugar Plc.	Sugar
Napolina Ltd.	Tinned fruit
Beecham Bovril Brands	Hot Chocolate
Erin Foods	Soup
Spillers Milling Ltd.	Flour
Tate & Lyle	Sugar
St. Ivel Ltd.	Dried Milk
United Biscuits Ltd.	Cheddar Biscuits
Symbol Biscuits Ltd.	Maryland Cookies
Cheshire Wholefoods Ltd.	Muesli and muesli bars
Playtime Foods Ltd.	Peanuts
H.P. Foods Ltd.	Tomato Ketchup and Baked Beans
R. Twining & Co. Ltd.	Earl Grey Tea
RHM Foods Ltd.	Gravy mix
Colman's of Norwich	Sauce mixes
Record Pasta	40kg Pasta
Nestle Co. Ltd.	Corned Beef
Master Foods	Rice and potato

ICI Pharmaceuticals	Various medical
Henley's Medical Supplies Ltd.	Various medical
Abbot Laboratories Ltd.	Erythromycin, eye drops
Cupal Ltd.	Insect Repellant
Leo Laboratories	Various medical
Euremica Ltd.	Thermometers
Burkard Ltd.	Hypodermic syringes
May & Baker Pharmaceuticals	Various medical
Roche Products Ltd.	Anti-malarials
CIBA Consumer Pharmaceuticals	Sunscreen
Schwarzkopf Ltd.	Sunglasses
Cynamid Pharmaceuticals	Various medical

We would like to take this opportunity to thank the following for their assistance:

In Zaire,
 Dr. Chris & Mairi Burnett
 Dr. Lyn Bulkeley
 Dr. Kasela, the Medecin Inspecteur Regionale
 Dr. Meli-Sanja, the Medecin Chef de Zone
 Our interpreters, Angelike and Tabu
 The boatmen, Lobanga and Tabu
 Mr. Akuma-Osiko Baelo, for typing the preliminary report
 All the chiefs of the villages where we worked
 And the people of Zaire for their warmth and hospitality

In the United Kingdom,
 Lord Swann
 Sir Vincent Wigglesworth
 Dr. William Cutting
 Dr. Ricky Richardson
 Dr. David Werner
 Mr. M.B. Pescod
 Miss Isabel Blackett
 Dr. Bernice Williams
 Dr. J.W. Maunder
 Mr. David Clarke and all those who helped at Mann Egerton
 Mr. Roger Craysthorpe
 Mr. Geoff Watkins
 Nigel and Shane Winser
 Mr. Nigel Carie
 Margerie Lovett
 The Porters and others at Gonville & Caius College

And all our parents.

Mechanical

1. Suggested modifications

Essentials

Replace rear springs with heavy duty type
Roof rack with plywood floor
Partition between storage area and seats
Bonnet mounted spare wheel - in addition to rear door mounted
Wire mesh on front lights - and rear if affordable
Electrical fire extinguisher

Optional

High mounted air filter - oil bath filter is perfectly adequate, but may be essential for cartridge filters (very expensive to keep replacing)
Oil temperature gauge - ours didn't work properly

2. Pre-expedition servicing

Engine

Drain oil, flush engine, replace filter, refill
Check compression and oil pressure
Check and reset valve clearances
Cooling system - drain and flush out
 check water pump and thermostat
 check hoses and replace as necessary

Gearbox and Transmission

Check overall condition, replace seals as necessary
Replace clutch if necessary - definitely check if have facilities and time

Steering

Check for alignment and play

Fuel System

Complete overhaul - check hoses and injectors
 check pumps (lift and injector)
 replace filter
 check condition of fuel tank

Suspension

As necessary - replace shock absorbers with heavy-duty shocks
 replace shock absorber bushes
Replace rear springs with heavy duty type

General

Full lubrication
Check nuts and bolts for tightness
Check condition of exhaust system - renew as necessary
Check wheel bearings - free with correct end float
Check hub oil seals
Check for excessive play in sliding and U/J's of prop shafts
Check brake system COMPLETELY - pipes, seals, cylinders etc

3. Spares and tools

Spares

- 6 Wheelnuts
- 6 Inner tube

- 1 Clutch plate
- 1 Pressure plate
- 1 Thrust bearing

- 1 Front s/absorber
- 2 Rear s/absorbers
Numerous s/absorber bushes and split pins

- 2 Rear wheel cylinders
- 1 Set front brake pads
- 4 Sets rear brake shoes
- 5 Hub bearing kits

- 2 Inlet valves - one per vehicle
- 2 Exhaust valves - one per vehicle

- 4 Injectors
- 5 Fuel filters

- 4 Air filter elements
- 1 Cartridge oil filter
- 1 Element oil filter

- 1 Radiator cap
- 1 Thermostat plus gasket
- 1 Set heater hoses - 110
- 1 Water pump - 110

- 3 Washer jets - 110
- 2 Wiper blades - 110
- 1 Wiper blade - 109

- 2 Fan belts - 109/110
- 2 Drive belts - 110
- 2 Head gasket sets - 109/110
- 4 Headlamp bulbs - 2 per vehicle
- 1 Headlamp unit - 110
- 4 Stop/tail bulbs
- 4 Indicator bulbs
- 2 Sidelamp bulbs
- 4 5/10/15/20/35 amp fuses
- 2 Long half-shafts - 110
- 1 Short half-shaft - 110
- 1 Long half-shaft - 109
- 1 Short half shaft - 109
- 1 Rear road spring - 109

Tools and materials

- 15 Water and fuel jerrycans
- 6 Gall engine oil
- 3 Litres distilled water
- 1 Litre grease
- 2 Litres brake fluid
- 4 4ft Sandladders
Pair long nosed pliers
Pair combination pliers
- 1 Jemmi bar
- 1 1lb Hammer
Large Pair mole grips
Hand drill plus bits
12v inspection lamp
Heavy duty jump leads
Flat and round files
Assorted nuts/bolts/screws
Self tappers
Jubilee clips
Electrical wire/connectors
Insulation tape
- 5 Tyre levers
Puncture repair kit
Petrol tank repair kit
Axe
String
Soldering iron/flux/solder
- 2 Tyre pressure gauges
- 2 Foot pumps (twin + gauge)
- 2 Warning triangles
- 3" Vice
Set screwdrivers
Set AF/Whitworth spanners
Feeler gauges
Cold chisel
Pin punch
Brake bleeding kit
Steel tape
Junior/senior hac saw
Radiator sealer
1" Paint brush
Side cutters
- 2 Hi-lift jacks
Wheel brace
Masking tape
- 1 Gall transmission fluid
- 2 Galls gear oil
Oil cans
Emery cloth