REPUBLIC OF ZIMBABWE

NATIONAL MALARIA CONTROL PROGRAMME

FIVE-YEAR PLAN

(1994 - 1998)

DISEASE CONTROL UNIT

MINISTRY OF HEALTH AND CHILD WELFARE

HARARE

1993

PREFACE

The National Malaria Control Programme in Zimbabwe has been expanding since it was introduced in 1948, experiencing phases of collapse and revival under the influence of socio-political changes. With independence in 1980, the programme was revamped nationally following a major outbreak in 1981. The initial thrust was primarily aiming at "preventing epidemics", until mid-1983 when a new strategy of reducing mortality and morbidity (and not merely "preventing epidemics") was adopted, with decentralization to provincial level and its incorporation into the primary health care system.

Malaria remains one of our major public health concerns. Recent outbreaks during good rainy seasons have shown us the need for concerted efforts by the general public, Government and its development partners to always provide for the requirements of malaria control activities.

This Plan aims at assisting us in specifying the activities which need to be undertaken towards malaria control and what resources need to be made available.

Effective implementation of this Plan is a positive step towards the goal of health for all.

Dr R R Chatora
Permanent Secretary
MINISTRY OF HEALTH AND CHILD WELFARE 8 April, 1994

INTRODUCTION

The need for preparing the current National Malaria Control Programme Plan (1994 - 1998) evolved from the fact that information on the programme as implemented up to now was fragmented, withouyt a clearly structured document containing most of the information appropriate for medium and long term planning and projections.

As malaria continues to be one of the major if not the major single disease problem of public health concern in some parts of Zimbabwe, it was considered appropriate to take stock of all the major considerations related to the disease and control efforts so far made in order to undertake a more comprehensive appraisal and to identify the existing gaps in knowledge about the host, vector, parasite and environmental as well as other factors which play part in persistence of the disease. Likewise, it is considered essential to look critically afresh at malaria policy, objectives, strategies, targets and indicators as well as to identify the role of potential and existing support mechanisms for better management of the Programme.

This document is intended to serve as a guide, especially to the provincial health authorities who will be operating their specific malaria control plans in the context of the overall National Disease Control Plan. It will also serve as a reference and reflection to all who are engaged in malaria control of more effective coordination and collaboration in our concerted efforts to bring malaria under control.

EXECUTIVE SUMMARY

The 5-Year Plan for strengthening the National Malaria Control Programme in Zimbabwe was prepared and is discussed in the following 7 Sections.

Section I - Background Information
This Section provides an overview picture of the geographical features and economic status of Zimbabwe portraying Zimbabwe as one of the Sub-Saharan countries affected by malaria due to its geographical position, as well as a brief description of economic and developmental activities influencing malaria trends.
Zimbabwe has a comprehensive health infrastructure with well-equipped central/referral, provincial, rural, district, private and mission hospitals. The peripheral health institutions: clinics and health centres operate under the auspices of central and local governments, private and non-governmental organizations, including religious and humanitarian organizations.
The main health strategy adopted in Zimbabwe is integrated Primary Health Care approach with emphasis on decentralization of the health administration.

Section II - Malaria Situation Analysis
This Section discusses the climatic conditions which favour the survival of the malaria vector mosquito, the Anopheles. It describes the altimetry of the country in relation to the characteristics of malaria transmission. The epidemiology of malaria indicates the distribution of types of malaria parasites and species responsible for malaria incidence and mortality occurring according to the seasons of the year and altitude.

Section III - Action Plan for Malaria Control in Zimbabwe
The major goals and objectives to be achieved as well as strategies to be adopted and activities to be performed are outlined in this Section, including case management, chemoprophylaxis in pregnancy and for travellers from non-malarious areas, vector control activities, personal protection measures, control of epidemics, health eduction, epidemiologic surveillance, training of health workers and applied research.

Section IV - Programme Management and Support
The various roles and functions of implementation levels are discussed in this section.

Section V - This Section outlines the major activities to be performed in the respective years of the 5-Year Plan, focusing on the strategies indicated in Section III.

Section VI - Total Budget for Malaria Control
The total budget or malaria control during the 5-Year Plan, earmarked by the Government of Zimbabwe and Donor Support is presented by items.

ACKNOWLEDGEMENTS

Preparation of the current Five-Year (1994 -1998) Plan for the Zimbabwe National Malaria Control Programme (ZNMCP) was initiated by Epidemiology and Disease Control Department headed by Dr Shiva Murugasampillay under the guidance of Dr P.L. N. Sikosana, the Deputy Secretary, Health Care Services. The technical support and guidance was provided by the WHO Epidemiologist, Dr A.Y. Mgeni, assisted by Mr I. Maunga, the Acting Chief Disease Control Officer and focal point for malaria control. In order to align the Zimbabwe National Malaria Control Programme with the overall policy of malaria Control in the WHO African Region, Dr L. Arevshatian, the WHO Representative for Zimbabwe facilitated the recruitment of Dr A. Beljaev, WHO Short-term Consultant Malariologist as an advisor.

In accomplishing the formulation of the 5-Year Plan, significant contribution were made by the Malaria Core Group comprised of Blair Research Laboratory, Environmental Health Department and Health Information Unit in the Epidemiology and Disease Control Department as well as the Malaria Task Force representatives from the Provinces, Nursing and MCH Departments, Public Health Laboratory, Pharmaceutical Services, Community Health Department of the University of Zimbabwe and Dr.S.K.K. Lutalo, Consultant Physician, Harare Central Hospital.

Commendable secretarial support was provided in the production of this document by Ms L. Mbewe, personal Secretary, and Mr I.Musana, Epidemiology and Disease ControL Department.

The Ministry of Health and Child Welfare wishes to extend their sincere gratitude to all who made their contributions to the success of this joint effort but for reasons beyond our control were not mentioned by name.

Any future contribution to the successful implementation of this Plan is highly appreciated.

CONTENTS

SECTION I - BACKGROUND INFORMATION

1. GEOGRAPHICAL FEATURES AND ECONOMIC STATUS

Zimbabwe lies between latitudes 15° and 22° 30' S and longitudes 25° and 33° E. The surface area of the country is 390. 249 km , with a population of million (1992 census). The country is divided into eight administrative provinces comprised of 58 districts.

The economy of Zimbabwe is relatively well developed and fairly diversified in agriculture and industry , including mining. Manufacturing products include food items, chemicals, textiles, wood, furniture, transport equipment, paper and machinery. The agricultural sector includes large commercial farms as well as a traditional farming system. Exports play a an important role in the economy (mostly mineral products, tobacco and other commercial crops, and animal products). The tourism industry is an important source of foreign exchange. There is a high standard network of the main roads and railways; but still, about 30 of peripheral clinics are without good communication.

The per capita GNP was US $ 1032 in 1987. The national currency is Zimbabwean (about US $ 0.12 end 1993).

In recent years, austerity measures such as the Economic Structural Adjustment Programme(ESAP) were adopted. Unfortunately, unfavourable economic trends prevailed and have been further aggravated by an unprecedented drought of 1991/1992.

2 THE HEALTH INFRASTRUCTURE

The main health strategy adopted in Zimbabwe is the Primary Health Care(PHC) approach with emphasis on decentralization of health administration and integration of health programmes at all levels of the health system.

The Health infrastructure is based on the government administrative structure. There are well-equipped provincial and district hospitals, except for inadequate laboratory facilities and skilled manpower shortage. The peripheral health institutions included 1099 clinics in 1990, belonging mostly to the central and local governments (320 and 470 respectively), followed by 254 private and 55 mission clinics. Community Workers (VCW) selected by their community.

SECTION II - MALARIA SITUATION ANALYSIS

Malaria is one of the most important communicable diseases in Zimbabwe. It contributed to about 20 - 30% of outpatient attendances of the age-group of 5 years and above. It occupied 4 - 6 positions among the children of below 5 years of age in 1987-89. Its impact is still high, as a disease of public health significance, if areas of perennial transmission are excluded. The importance of malaria is illustrated by the fact that the Government of Zimbabwe is forced to spend about US $ 2, 000,000 annually on malaria control in perennial transmission areas and on epidemics.

1. MOSQUITO-VECTOR AND ENVIRONMENTAL CONDITIONS

The level of transmission of malaria varies from the level of hyper-endemicity in the Zambezi valley (lowveld) to zero endemicity in the highveld. The areas which are essentially free from malaria transmission are limited by the isohypse of over 1200 m in the north and 900 m in the south. This malaria free zone is stretches from north-est to south west, dividing the high malaria transmission into two isolated parts, the northern part and the southern one.

1.1 Climate

There are three main seasons of the year:
- cool-dry season - (May to mid-August)
- hot-dry season - (mid-August to October
- hot-wet climate - (December to April)

In isolated lowveld malarious areas with some water collections, mean monthly temperatures are above 18 C even during the cool-dry season (when other parts of the country experience cool weather) thus providing favourable conditions for vector breeding. Vector breeding and transmission increase during the hot-dry and hot-wet seasons.
The above trends are explained, bearing in mind that during the hot-dry season, mean monthly temperatures increase up to 26 C. However, rainfall remains insufficient (0-10 mm) in September, and 2.5-25 mm in October. As a result , mosquito populations are very low. During the rainy season, men monthly temperatures are between 26 C and 30 C. Rainfall increases to 25-100 mm in November, reaching its maximum in December- February(100-200 mm), and then gradually declining to 50-100 mm in March and 10-25 mm April. Generally speaking, this is the most favourable period for transmission for malaria.

In some areas, the patterns of rainfall are deviating from this scheme. In the mountains of the extreme east of the country, rainfall is more abundant and more evenly distributed during the year. In lowlands of the south, rainfall is less abundant than in the north during November to March; however, during the months of June and September, the situation is inverse. In non-malarious belt above 1200 m , rainfall is usually more abundant, especially in the north east.

1.2 Malaria Vectors

The main vectors of malaria in Zimbabwe belong to **Anopheles gambiae complex**. The most widespread vector, **A.arabiensis**, belongs to this group, as well as a much less prevalent **A. gambiae s.s.**, a non-vector, **A.quadriannulatus**, and, possibly, some other sibling species. The breeding places are typically small water bodies with very slow-moving or stagnant water exposed to direct sunlight, such as hoof-prints. These breeding places are particularly abundant by the end of the rainy season, which makes larviciding impracticable, with few exceptions. Members of **A.funestus** complex are presently occurring at low altitudes in the north. In the past, **A.funestus** was more widespread, but on higher altitude it has been eliminated by insecticidal measures. At the time, it was considered to be an important vector, but its present role is undetermined, since the species composition of this complex might have changed due to the insecticide pressure. the role of secondary vectors, such as **A.pretoriensis**, is not clear.

Past information on the bionomics of **A. gambiae** and **A.funestus** is often confusing, since much of the information was collected before the recognition of the specific status of the members of these complexes. More recent studies by Mpofu(1985) conducted near the confluence of Nyaguwe and Mazowe rivers in Mashonaland East Province (alt.820 m), indicate that **A.arabiensis** was the main vector in the area, while **A. gambiae s.s.** could also play a role in the transmission. Both species occurred between February and May, with peak incidence in March. **A.funestus** and **A.quadriannulatus** could be collected throughout the year. **A. arabiensis** exhibited highly exophagic and anthropophilic behaviour.

Insecticide sensitivity tests failed to demonstrate any resistance to DDT and synthetic pyrethroid in the Anopheles of Zimbabwe.

2. STRATIFICATION OF MALARIA ZONES IN ZIMBABWE

Fig.5 shows how Taylor (1985) demonstrated the linkage between the altitude and malaria transmission in Zimbabwe. In active case detection, the slide positivity rate (SPR) in the northern areas below 600 m was far above the SPR in any other area. The altitude zones in the north and in the south are not directly comparable because of lower mean temperatures in the south. Malaria transmission in the 600-900 m south zone is probably equivalent to that in the 900-1200 m in the north. Based on this, three strata of malaria have been recognized in Zimbabwe as follows:

- Areas below 900 m in the north and 600 m in the south, characterised by endemic malaria with perennial transmission;

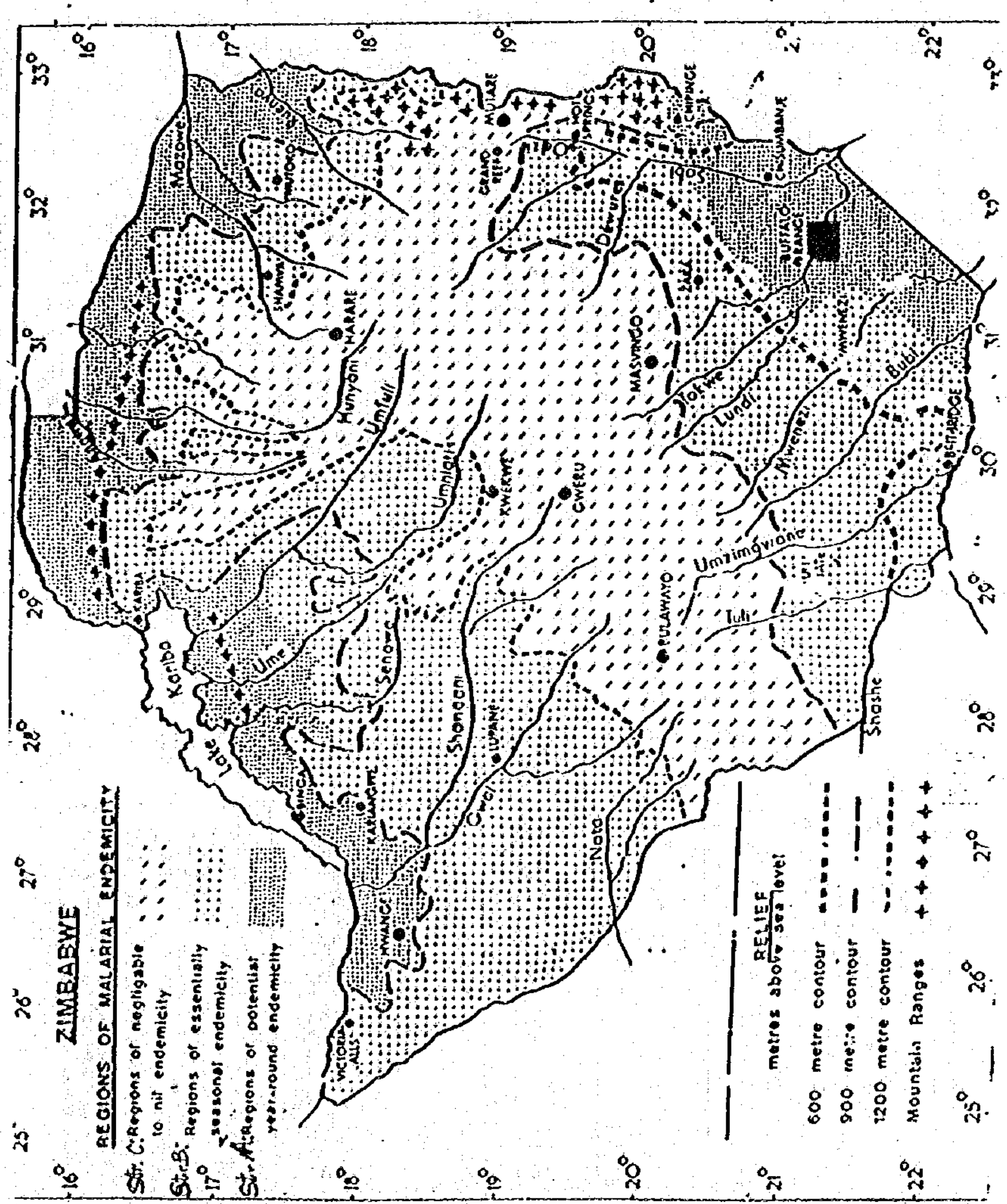

ZIMBABWE
REGIONS OF MALARIAL ENDEMICITY
St. C. Regions of negligable to nil endemicity
St. B. Regions of essentially seasonal endemicity
St. A. Regions of potential year-round endemicity
RELIEF
metres above sea level
600 metre contour
900 metre contour
1200 metre contour
Mountain Ranges
Lake Kariba
HARARE
MASVINGO
BULAWAYO
GWERU
KWEKWE
MUTARE
LUPANE
HWANGE
SHAMVA
GRAND REEF
CHIPINGE
CHISUMBANJE
BUFFALO RANGE
BEITBRIDGE
VICTORIA FALLS
Mazowe
Hunyani
Umfuli
Umniati
Sengwa
Ume
Shangani
Gwai
Nata
Umzingwane
Tuli
Shashe
Bubi
Mwenezi
Lundi
Tokwe
Devure

Table 1
Estimated population of malarious areas in Zimbabwe by strata

AREA	Population, 1991 (thousands)	
	Rural	Urban
North, below 900 m	650	80
South, below 600 m	460	30
Subtotal (STRATUM A)	1110	110
North, 900-1200 m	1560	190
South, 600-900 m	1010	0
Subtotal, (STRATUM B)	2580	190
TOTAL	3680	300

Table 2
Estimated population of malarious zone province-wise
(1991, in thousand)

	Province	Stra-tum A	Stra-tum B	Zones A and B combined	Total prov-ince
1	Manicaland	232	329	561	1345
2	Mashonaland C.	160	372	532	753
3	Mashonaland E.	109	193	302	2272
4	Mashonaland W.	108	453	561	870
5	Masvingo	286	496	782	1338
6	Matabeleland N.	144	369	513	1373
7	Matabeleland S.	53	165	218	618
8	Midlands	124	385	509	1516
	Total	1216	2762	3978	10084

low H.D.

(C = High level)

- Areas between 900 m and 1200 m in the north and between 600 m and 900 m in the south, experiencing epidemic malaria;
- Areas above 1200 m in the north and 900 m in the south, considered to be non-malarious, with possibilities of outbreaks occurring in areas where the vector mosquitoes could infringe from the adjacent lower strata, especially during the years with unusual patterns of rainfall and /or temperature.

This classification may be adopted as a framework for operational malaria stratification as follows:

Stratum A.
Endemic areas with perennial transmission (below 900 m in the north and 600 m in the south in the lowveld);

Stratum B
Hypo- to meso-endemic areas with seasonal and, in the absence of control, with yearly epidemics (between 900 m and 1200 m in the north and between 600 m and 900 m in the south in the middleveld);

Stratum C
Areas with normally negligible or no transmission, where rare but sever epidemics may occur at irregular intervals (just above 1200 m in the north and 900 m in the south in the highveld).

2.2 Estimated Human Population at Risk of Malaria

The populations of strata A and B have been estimate by combining two maps: Zimbabwe relief (8th edition, 1984) and Zimbabwe population distribution, August 1982. The obtained figures were further multiplied by 1.324, to take into account the 32.4% increase of the population of Zimbabwe during the period 1982 - 1991, assuming that the increase was uniform in various areas. The estimated population of that part of the malarious zone where transmission of malaria occurs regularly is about 40% of the total population of Zimbabwe, as shown in Tables 1 and 2. This does not, however, include the population of Stratum C, to be estimated through research. Although it seems that the altitude is a good basis for stratification, more precise delimitation of the strata requires additional research or epidemiological studies, particularly for determination of whether there is need to create demarcated strata D from strata C.

3 EPIDEMIOLOGY OF MALARIA IN ZIMBABWE

3.1 Distribution of Type of Malaria Parasites and Species

The three species of malaria parasites known in Zimbabwe are **Plasmodium falciparum, Plasmodium ovale, and Plasmodium malariae,** out of which P. falciparum clearly predominates (see Table 3)

Table 3
Species distribution of malaria parasites

Study	Share of:		
	P. falciparum	*P. malariae*	*P. ovale*
Active case detection, 1969-1981[1]	91.1	8.2	0.7
Passive case detection, 1972-1981[1]	97.8	1.8	0.3
Passive case detection, 1991[2]	99.7	0.26	0.05

The difference between the active and passive case detection is probably due to the fact that **P. malariae** and **P. Ovale** tend to produce less severe infections. Decreasing proportion of these species in the recent observations may be the result of the widespread use of antimalarials to which **P. malariae** and **P.ovale** are more susceptible than **P. falciparum.** The present quasi non-existence of the former two species allows to skip a discussion of **P.falciparum** species-specific rates which are practically equal to general parasite rates.

3.2 Parasite Resistance to Antimalarial Drugs

Resistance of P. falciparum to chloroquine was for the first time recorded in Zimbabwe in 1986. Since then confirmation of choloroquine resistance has been documented in various parts of the country in the malaria transmission zones in the lowveld and middleveld. The Ministry of Health and Child Welfare is in the process of mapping drug resistance in the country.

3.3 Incidence of Malaria Cases

The recorded number of confirmed cases of malaria in 1991 is shown in Table 4.

The existing data do not permit to analyze the situation according to the above described strata in a direct way, because the data was processed by administrative districts and provinces, and each of the eight provinces include each of the three malaria transmission zones described above. One way of comparing differrent provinces is to calculate malariometric

rates by population of combined strata A and B which generate most of the blood examinations. The results of this calculation are presented in Table 5. The conventional rates which are utilized are explained in Annex 1.

Table 4
Confirmed cases of malaria, 1991

Provinces	Number examined	*P. falciparum*	*P. malariae*	*P. ovale*
Manicaland	13428	1166	9	2
Mashonaland Central	14525	1681	7	1
Mashonaland East	9127	1969	4	0
Mashonaland West	16921	1508	9	2
Masvingo	5969	212	1	0
Matabeleland North	18266	3474	2	1
Matabeleland South	5482	182	0	0
Midlands	4665	1744	0	0
National Total	88383	11936	32	6

Table 5
Malariometric rates, 1991

Provinces	ABER[1]	API[2]	SPR[3]	PFG%[4]
Manicaland	2,39	2,10	8,77	3,69
Mashonaland Central	2,73	3,17	11,63	5,83
Mashonaland East	3,02	6,53	21,62	1,93
Mashonaland West	3,02	2,71	8,98	14,32
Masvingo	0,76	0,27	3,57	7,08
Matabeleland North	3,56	6,78	19,04	5,96
Matabeleland South	2,51	0,83	3,32	0,00
Midlands	0,92	3,43	37,38	4,01
National Total	2,22	3,01	13,55	5,76

[1] Annual Blood Examination Rate per 100 population of malarious zone
[2] Annual Parasite Incidence per 1000 population of malarious zone
[3] Slide Positivity Rate per 100 examined
[4] Percentage of gametocytes in *P. falciparum* cases

Table 6
Age distribution of confirmed malaria cases, 1991

Provinces	Number of positives, age-wise				
	<1	1-4	5-9	10-14	>=15
Manicaland	30	148	166	181	680
Mashonaland Central	93	380	252	208	803
Mashonaland East	54	216	332	256	1142
Mashonaland West	30	156	140	140	1248
Masvingo	7	20	21	20	160
Matabeleland North	82	350	615	908	1725
Matabeleland South	1	12	)	29	131
Midlands	114	364	104	177	958
National Total	411	1646	1719	1919	6847
Share of the age group among all the cases	3.3	13.1	13.7	15.3	54.6
Share of the age group in the total population	3.6	13.9	16.4	13.8	52.3

Table 7
Age-specific Annual Parasite Incidence (API)

Provinces	Age-specific API					
	<1	1-4	5-9	10-14	>=15	Total[1]
Manicaland	1.48	1.90	1.81	2.34	2.32	2.15
Mashonaland Central	4.83	5.14	2.90	2.83	2.89	3.26
Mashonaland East	4.94	5.14	6.72	6.14	7.23	6.62
Mashonaland West	1.48	2.00	1.53	1.81	4.25	3.06
Masvingo	0.25	0.18	0.16	0.19	0.39	0.29
Matabeleland North	4.42	4.91	7.33	12.81	6.43	7.17
Matabeleland South	0.13	0.40	0.25	0.96	1.15	0.83
Midlands	6.19	5.14	2.21	2.52	3.60	3.53
National Total	2.86	2.98	2.64	3.49	3.29	3.15

[1] Slight difference between this column and API in Table 5 is explained by the fact that cases of unknown age have been included in the latter.

The age distribution of confirmed cases of malaria is presented in Table 6. These data have been recalculated to obtain age-specific rates. For this, age-specific population of malarious zone was first calculated from the data of Table 2 using the age distribution of the population (Annex 2). The obtained figures were used as a denominator. The results are presented in Table 7.

The age distribution of cases of malaria and the age of severe cases may give an idea of the endemicity of malaria. The data of Table 7 suggest that the level of immunity is, in general, not very high, since the incidence of malaria is distributed more or less uniformly throughout the age groups. Only in Mashonaland Central Province and Midland Province are the children more markedly affected than the adults which indicate that hyperendemic situation exists in parts of these provinces. The uniform distribution of incidence in other provinces may be a result of loss of immunity due to continuous vector control. However, the fact that the provincial data do not distinguish between the strata may have masked the existence of hyperendemic pockets also in other provinces.

Diagnosis of malaria is mostly established without a parasitological confirmation, even in hospitals. It is with this reservation that the information on hospitalized cases and deaths due to malaria should be analyzed (Table 8).

Table 8
Hospitalized cases of malaria and deaths due to malaria, 1991

Provinces	<1 year		1-4 years		>=5 years		Total	
	C	D	C	D	C	D	C	D
Manicaland	392	11	1154	9	3731	81	5277	101
Mashonaland Central	338	18	919	15	2923	85	4180	118
Mashonaland East	127	9	198	4	1196	24	1521	37
Mashonaland West	279	8	732	13	4452	116	5463	137
Masvingo	346	17	550	4	1387	32	2283	53
Matabeleland North	364	4	978	9	1811	20	3153	33
Matabeleland South	10	0	69	2	718	3	797	5
Midlands	118	4	167	2	1065	17	1350	23
National Total	1974	71	4767	58	17283	378	24024	507

NOTE: Data are missing from Harare Central Hospital, Patirenyatwa Central Hospital, United Bulawayo, Kpilo Central Hospital

The data of Table 8 have been recalculated to obtain age-specific indices: incidence of hospitalized cases of malaria (IHCM)and hospital mortality due to malaria (HMM) per population o malarious zone, and mortality per 100 hospitalized cases of malaria. The procedure used was the same as in producing Table 7. The results are presented in Table 9.

Table 9
Hospitalised cases of malaria: Incidence,, fatality ', mortality

Provinces	Age groups			
	<1 year	1-4 years	>=5 years	Total
Incidence of hospitalized cases per 1000 population				
Manicaland	19.31	14.79	8.06	9.41
Mashonaland Central	17.56	12.42	6.66	7.86
Mashonaland East	11.62	4.71	4.80	5.04
Mashonaland West	13.74	9.38	9.62	9.74
Masvingo	12.23	5.06	2.15	2.92
Matabeleland North	19.61	13.71	4.28	6.15
Matabeleland South	1.27	2.28	3.99	3.66
Midlands	6.41	2.36	2.54	2.65
National Total	13.71	8.62	5.27	6.04
Lethality (case fatality rate) of malaria (%)				
Manicaland	2.81	0.78	2.17	1.91
Mashonaland Central	5.33	1.63	2.91	2.82
Mashonaland East	7.09	2.02	2.01	2.43
Mashonaland West	2.87	1.78	2.61	2.51
Masvingo	4.91	0.73	2.31	2.32
Matabeleland North	1.10	0.92	1.10	1.05
Matabeleland South	0.00	2.90	0.42	0.63
Midlands	3.39	1.20	1.60	1.70
National Total	3.60	1.22	2.19	2.11
Hospital malaria mortality per 100000 population				
Manicaland	54.2	11.5	17.5	18.0
Mashonaland Central	93.5	20.3	19.4	22.2
Mashonaland East	82.4	9.5	9.6	12.3
Mashonaland West	39.4	16.7	25.1	24.4
Masvingo	60.1	3.7	5.0	6.8
Matabeleland North	21.5	12.6	4.7	6.4
Matabeleland South	0.0	6.6	1.7	2.1
Midlands	21.7	2.8	4.0	4.5
National Total	49.3	10.5	11.5	12.7

Patterns of distribution of microscopically confirmed and so called clinical cases have been compared using the Spearman's rank correlation method. One can except that the provinces with the highest API in a particular age group would rank high also in IHCM in the same group. This, however, was not the case (see Annex 3 for details). A plausible explanation of this disagreement between parasitological and clinical indices seems that there are many cases of non-malaria among reported clinical malaria cases. It seems, in addition, that criteria for diagnosis (or misdiagnosis) of malaria are not the same in young children and in the group above 5 years of age and neither are they the same in different provinces.

3.4 Seasonality of Malaria Occurrence

During the dry-cool season, transmission of malaria is impossible due to low temperatures, except in the lowveld where it is, however depressed due to low humidity and scarcity of breeding places. Nonetheless, large numbers of **A.gambiae s.l.** may be captured close to residual water bodies even during this period of low transmission. Mosquitoes take advantage of the pools left by major rivers drying up and this does result in winter(cool-dry) outbreaks if temperatures are not too low.

The onset of rain in November and high temperatures create more favourable conditions for survival of mosquitoes between this time and January. However,little surface water is available at the beginning of this period. Malaria transmission is high between February and May though it may be depressed by heavy rainfall occurring in February and March. The rainfall ends fairly consistently in March. Therefore, the transmission often peaks in March/April declining rapidly as breeding sites disappear. For areas at the fringe of malarious zone this is the only period when transmission of malaria is possible.The maximum of recorded incidence occurs 2 to 4 weeks later. In years with conditions particularly favourable for malaria transmission it could occur even above 1200 m during this period, but it has been limited in extent. This happened, for example, during the first half of 1992.

The factors limiting malaria transmission at low altitude after the main rains are not so much to do with low temperature, but a reduction of vector population by low humidity and decrease in the number of suitable breeding sites.

3.5 Correlation between Clinical Malaria and Parasite Incidence

Seasonality of malaria may be illustrated by data of 1990/91 epidemiological year. During this year the incidence of malaria was concentrated mostly north of the country. In five northern provinces: Mashonaland East, West and Cental, in Matabeleland North and in Midlands there was marked seasonal

increase of malaria during the main rainy season.
The highest incidence with a typical seasonal curve of parasite incidence (PI) and blood examination rate (BER) was observed in Matabeleland North Province (Fig.1). The rise of monthly parasite incidence started from January, culmminated in February and returned to a low level in June. The blood examination rate also increased during the epidemics due to a rise in fever cases. It remained, however, quite high also during the period of negligible.

An abnormal curve of BER was observed in Mashonaland East Province. The BER was very high in July, in the wake of the previous epidemics, while during the period of increased incidence itsrise was insignificant (Fig.2).

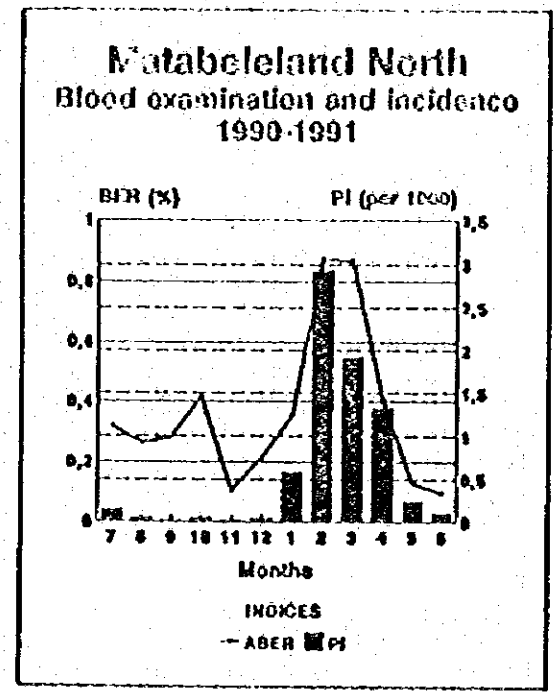


Fig. 1

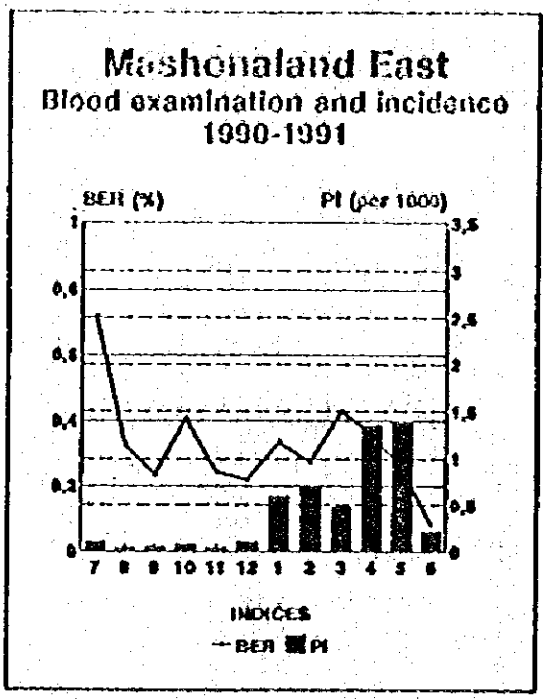


Fig. 2

The sum of the five northern provinces is presented in Fig.3. The seasonal increase in PI is obvious, and it coincides with an increase in the BER. However, the BER is quite high even during August-December when malaria incidence is very low. This is probably due to a non-application of clear cut clinico-epidemiological criteria for selecting cases for blood examination.

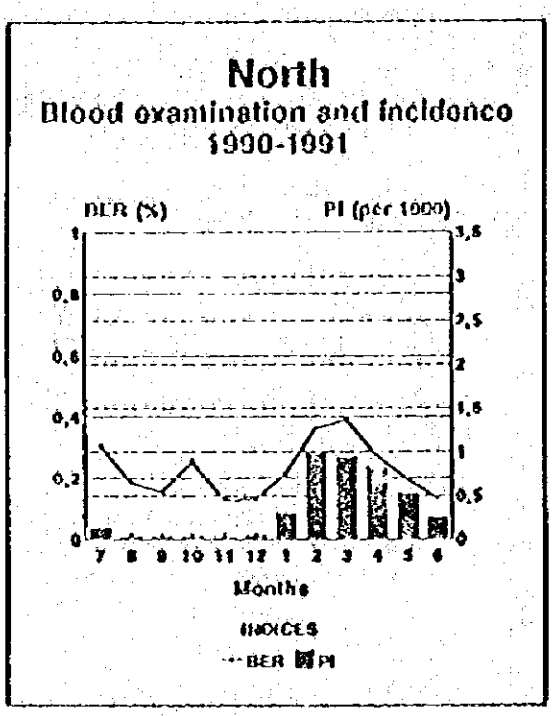


Fig. 3

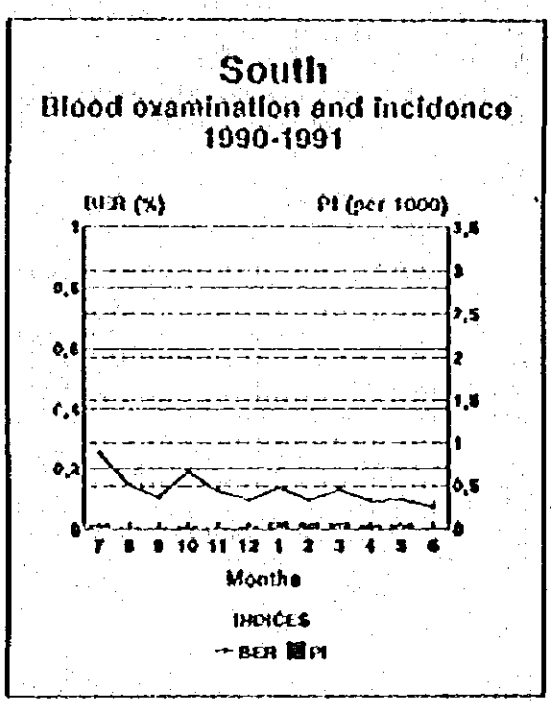


Fig. 4

In the southern provinces: Manicaland, Masvingo and Matabeleland South, malaria incidence was fairly low during this period. Its seasonal increase was hardly observable (Fig.4).

3.6 Antivector Activities

As described by Taylor and Mutambu (1986), pilot malaria control operation started in Zimbabwe in 1949 and was later extended to several epidemic-prone areas of the country. The intervention measure was spraying using BHC and DDT. Increasing incidence of malaria in highveld stimulated the introduction of spraying in areas of unstable malaria in 1972 using BHC until 1974 and then DDT thereon. The results were very good but the intensification of the liberation war from 1972 reduced the scope of operation. The effects of control, however, persisted until 1978, when the resurgence of malaria climaxed in the summer 1979 - 1980 by the worst epidemics since the introduction of residual spraying.

Residual spraying recommenced in 1980 with the same emphasis on areas of unstable malaria. As a result, the epidemics were soon brought under control. From 1983 the objectives of the control were revised with a view of reducing morbidity and mortality rather than only preventing epidemics. The antimalarial spraying was shifted to endemic areas, and reduced or even abandoned in areas of unstable malaria. This probably provoked a number of outbreaks which are summarized in Table 10, which indicated that most of them occurred in areas of unstable malaria.

From 1988 deltamethrin (Cislin) was introduced as a residual insecticide. By now, it has almost replaced DDT. The reasons for that shift were better acceptability of Cislin by the community and fear of environmental "unfriendliness" of DDT. However, high cost of Cislin and shorter residual effect are considered some of the disadvantages of this insecticide.

During the 1980s spraying operations usually started before the heavy rains, beginning from the areas of lowveld. Therefore, areas of middleveld often remained unsprayed due to shortage of time before the onset of rains or due to lack of resources.This is probably the reason why epidemics were os regular during this period. To avoid destructive epidemics in the future, priority should be given to the epidemic-prone areas. The insecticide(s) to be used should have the period of residual action sufficient to ensure protection of about 6 months, i.e. from the time of spraying before the rains start in November up to the end of the major period of transmission in February - April.

Long history of residual spraying probably eased the malaria situation but decreased the level of immunity in the population (some indications of that have been discussed earlier). It seems, therefore,that any withdrawal for spraying should be done cautiously, after ensuring the availability of adequate case management at the very peripheral level of the health services.

Table 10
Malaria epidemics in Zimbabwe

Year	Province	District	Areas
1961	Midlands	Gokwe	Mafungabusi
1972	Matabeleland N.		
1974	Manicaland	Buhera	Along the Save r.
1985	Matabeleland S.	Beitbridge	East
1986	Midlands	Gokwe	N.-E. of Chereye
1986	Matabeleland S.	Beitbridge	Maninju (N.-W.)
1986	Mashonaland C.	Rushinga	
1987	Midlands	Gokwe	around Chereye, Madziwadzido
1987	Mashonaland C.	Guruve	Plateau
1987	Matabeleland N.	Nyamamandhlovu	Tjolotjo
1987	Matabeleland N.	Hwange	
1988	Midlands	Gokwe	around Chereye, Madziwadzido
1988	Mashonaland C.	Guruve	Plateau
1988	Matabeleland S.	Bulilimamangwe	North
1988	Manicaland	Makoni	Tanda, Mayo
1988	Matabeleland N.	Hwange	around the city
1988	Manicaland	Chipinge	Mt Selinda
1989	Midlands	Gokwe	around Chereye
1990	Manicaland	Nyanga	Elim
1990	Manicaland	Chipinge	Sale valley
1991	Mashonaland C.	Centenary	Muzarabani
1991	Midlands	Gokwe	around Chereye
1992	Midlands	Gokwe	around Gokwe town
1992	Midlands	Kwekwe	around Empress Mine
1992	Manicaland	Chimanimani	

Note: names of the places are given according to the map "Zimbabwe - land classification", Harare, 1985

From 1988 deltamethrin (Cislin) was introduced as a residual insecticide. By now, it almost replaced DDT *(maps to be included:*

4. ANALYSIS ON THE MALARIA SITUATION IN ZIMBABWE

Based on the information provided and on analysis of that information the following observations are made:

4.1 Situation Analysis

The malaria situation in Zimbabwe is very heterogenic and depends on geographical conditions (mosi ly altitude and rainfall) in a much precise and definite way, which provides a good basis for stratification of malaria.

4.2 Existing Surveillance System

The existing system of surveillance does not permit to conduct a comprehensive analysis of the malaria situation due to mixed data from different strata.

4.3. Impact of Malaria Vector Control on Immunity

Probably the antivector activities have reduced the level of collective immunity of the people in endemic malarious areas. However, the difference in the immunity status of people between the strata appears to be still existing.

4.5 Sustainability of Residual Spraying

Spraying with residual insecticides would give spectacular results in epidemic-prone areas, if it were conducted in sustained manner.

4.6 Diversification of Antimalarial Strategies

Realization of malaria programme presupposes a diversification of antimalarial strategies in various epidemiological situations on the basis of a stratified approach.

SECTION III - ACTION PLAN FOR MALARIA CONTROL IN ZIMBABWE

1. GOALS AND OBJECTIVES

Keeping in view the diversity of malariology situation in Zimbabwe, the goals of the malaria control programme as well as the measures to be taken should be stratified.

The goals to be reached in each stratum are to reduce duration of illness and to minimize the incidence of severe and complicated cases of malaria and to reduce mortality due to malaria. The risk groups will, evidently, vary from one stratum to another. For example, the high risk groups willbe mostly young children and pregnant women in highly endemic areas, while in malaria transmission free areas such groups include visitors to the endemic areas and travellers from non-malarious countries or non-malarious parts of other countries with malaria.

In addition to these general goals, specific goals are proposed for particular strata, as presented in Table 11

Table 11
Goals of malaria control in Zimbabwe

GOALS	STRATA		
	A	B	C
1. To reduce duration of the illness and to minimise incidence of severe and complicated cases of malaria.	+	+	+
2. To reduce mortality due to malaria.	+	+	+
3. To decrease the incidence of low birth weight due to malaria.	+		
4. To control seasonal outbreaks of malaria.		+	
5. To prevent epidemics of malaria.		+	+

In order to reach these goals, the following objectives are presented to be achieved by the end of the 5-Year Period in Table 12.

Table 12
Objectives of malaria control in Zimbabwe

GOALS	OBJECTIVES
1. To reduce duration of the illness and to minimise incidence of severe and complicated cases of malaria.	A. To assure correct case management in 90% cases of fevers B. To assure proper referral in severe and complicated cases of malaria in 90% of cases
2. To reduce mortality due to malaria.	C. To assure proper treatment of the referred cases in 100% of cases
3. To decrease the incidence of low birth weight due to malaria.	A. To assure chemoprophylaxis to 80% of pregnant women living in areas of stable malaria (stratum A)
4. To control seasonal outbreaks of malaria.	A. To suppress malaria transmission in epidemic-prone areas by regular spray and other antivector measures if applicable
5. To prevent epidemics of malaria.	A. To assure early warning on impending epidemics B. To develop capability of a rapid deployment of insecticides and equipment

In order to achieve the objectives of malaria control in Zimbabwe, a number of strategies are stipulated and the activies are described in the rest of this section.

2. MALARIA CONTROL STRATEGIES

2.1 Case Management

In order to attain an objective of limiting the severity and duration of illness of malaria cases and, subsequently, to reduce the mortality, early diagnosis and prompt treatment are essential. Experience has shown that even in chloroquine resistant malaria cases, usually the condition will be under control if treated during the first hours of the symptoms. The idea is that in case of therapeutic error treatment with chloroquine cannot do any harm. However, this should not lead to an indiscriminate use of chloroquine, and therefore calls for clinicians are to exhaust all considerations for differential diagnosis before they decide to prescribe an antimalarial drug.

2.1.1 Diagnosis of Malaria

Diagnosis of Non-Severe/Non-complicated Malaria Cases
In the majority of cases, diagnosis will be based on clinical observations. In order to orient the health care providers, the tree to guide decision-making will be utilized based on the example from the "Guidelines for diagnosis and treatment of malaria in Africa"(WHO/AFRO, 1992).

Microscopical diagnosis will be reserved for special cases. For clinical management, district/provincial laboratories will take blood slides from all suspected cases, if blood examination results will be assured on the same day. In such cases, presumptive treatment is to be given to all the patients from whom blood has been taken, followed by full treatment in case of a positive or convincing diagnoses. The number of slides examined by the laboratory technician is to be limited to a reasonable number per day, depending on the workload and the nature of cases. In case of an overload, priorities of blood examination will be established by the institution based on the at high risk principle, such as children, pregnant women, referral/referred cases, severe cases, etc.

Diagnosis of Severe Cases
Severe cases are conditions in which on or several of the following signs appear:

- repeated vomiting;
- mental confusion, inadequate behaviour;
- drowsiness, comma;
- pulmonary oedema;
- renal failure;
- circulatory collapse, shock;
- spontaneous bleeding;
- haemoglobinuria;
- severe anaemia (haemoglobin below 70g/l);
- high parasitaemia (5+, or more than 100 parasites per microscopic field).

Such cases should be referred immediately to an adequately equipped hospital. For such patients a drug of choice is quinine given in a drip (see Annex 5). In cases where the adult patient needs to be transported to another institution and intravenous treatment is not possible an intramuscular dose of quinine is to be given before transportation.

Laboratory Diagnosis
Laboratory diagnosis will be mandatory in cases of:

- presumptive therapeutic failure;
- complicated cases;
- referred cases

Selected hospitals with reliable laboratory facilities will be designated to carry out in vivo tests, where this is required.

On lower levels of the health system, microscopic facilities will be established in all institutions manned by clinicians who are responsible to handle referred and severe/complicated cases, and in institutions in remote areas, from which prompt referral is difficult to organize, in which case special training provisions and supervision on performance over laboratory examinations will be made for the staff responsible for determining adequate pre-referral management of a severe/ complicated malaria cases.

Blood examination will be semi-quantitative and subjected to systematic quality control. The procedures for blood examination and supervision are described in Annex 4.

2.1.2 Drug Policy

The first line drug is choloroquine: in the adult the dose of 25mg/kg over 3 days or as may be recommended by EDL(Z is prescribed as soon as malaria is suspected. For other age-specific doses of recommended antimalarial see Annex . As far as possible the initial dose should be taken in the presence of the health worker or other responsible person and the rest of the drug is given to the patient or responsible person with clear verbal and as far as possible written instructions.
In case of vomiting within 30 minutes of oral administration of the drug, injectable chloroquine may be given to adults by a certified clinician, but it is contraindicated in children below the age of 10 years.
Therapeutic failures are defined as cases where:

- There is no clearance of fever within 72 hours from the beginning of treatment;
- There is no clearance of parasitaemia within 96 hours from the beginning of treatment;
- There is recurrence of fever or parasitaemia within 14 days from the beginning of treatment.

In such cases, a combination of Sulpha/pyrimethamine (Fansidar) is to be given, in a single dose (3 tablets for an adult).

In case of vomiting (in uncomplicated cases of therapeutic failure) within 30 minutes of taking the oral drug, it is advisable to give injectable form of (quinine or Fansidar) by a certified nurse.

Levels of Prescribing Treatment for Malaria in Malarious Areas:
Treatment for malaria is given at various levels depending on the nature and severity of cases as follows:

- At household level, the community is to be educated as to suspect malaria in all fever cases in malarious areas and to administer early treatment where there is no health provider or health worker;

- At village level, where there is no basic health institution, potential health providers for malaria clinical management, depending on their level of training and/or orientation, are village community workers, school teachers, community leaders who have received appropriate training to administer the first-line drug, who should also know what kind of malaria cases they should refer ;
  Where there is a health post, clinic or health centre with at least a certified nurse in line with the prevailing drug policy and regulations, a second line of drug can be ministered in case of therapeutic failure in addition to the above, and the first parenteral dose of antimalarial to the severe cases which are referred to a higher level;
- In a hospital, with a medical doctor, severe cases will be treated accordingly;
  Severe cases requiring specialized treatment such as renal failure are referred to a higher specialized referral level (referral/central hospital), bearing in mind that every effort has to be made to initiate the antimalarial treatment before transportation of the referred patient.

Imported Malaria

Particular attention is to be paid to timely diagnosis of malaria cases outside the malarious area. For this, health workers are to be trained to inquire about travel history of each case of fever, in order to detect imported malaria.

2.2 Chemoprophylaxis in Pregnancy

It is well known that semi-immune pregnant women are prone to clinical malaria. No less important is the fact that they may have parasitaemia which is clinically silent, but which, nevertheless, severely affects the foetus. In these circumstances, systematic treatment of fevers will prevent serious threat to the foetus only in those women in whom malaria is overt. To cover also those in whom parasitaemia is silent and nothing signals the impending danger to the unborn baby, prophylaxis is applied. Therefore, chemoprophylaxis in pregnancy is recommended only in highly endemic areas where semi-immune status is common. In epidemic-prone areas, prophylaxis is not indicated on two grounds: because the risk of infection is relatively small, and because an infected woman usually develops overt infection which can be taken care of through appropriate case management procedures. Therefore, chemoprophylaxis in pregnant women seems justified in areas which fall under stratum A only.

Chemoprophylaxis in pregnancy consists in weekly administration of blood schizontocide, usually chloroquine.

Due to a widespread resistance of P. Falciparum to choloroquine, it is doubtful whether chloroquine is appropriate or effective. It is therefore, recommended that a combination of pyrimethamine and dapsone be used where there are no contraindications. The recommended schedules for its use are given in Annex 7.

Chemoprophylaxis must be preceded by a treatment of parasitaemia by administering a full course without microscopic examination, remembering that placenta may be heavily infected even when peripheral parasitaemia is subpotent.

In case of febrile illness in pregnancy, early treatment should be given at first suspicion of malaria and before microscopic confirmation. Laboratory examination is desirable and should not be delayed if facilities are available.

Due to many lacunae in the present knowledge of the effectiveness of chemoprophylaxis in pregnancy in the Zimbabwean set up, its widespread use is justified only after additional research. The main questions to be elucidate include:

- Sustainable schedules of dapsone/pyrimethamine;
- Cost-efficiency of chemoprophylaxis in general;
- delimitation of areas where chemoprophylaxis is likely to be cos-efficient;

2.3 Chemoprophylaxis for Visitors from Non-Malarious Areas including Travellers

In view of the fact that more than half of the population of Zimbabwe inhabit non-malarious areas and have no immunity to malaria, chemoprophylaxis for travellers from non-endemic stratum C to highly endemic stratum A is of great importance.

2.4 Vector Control

The main method of vector control in Zimbabwe is spraying of human dwellings. During the past few years, two insecticides were used: DDT and deltamethrin. Out of the two, the first is preferable due to its lower cost and longer residual action. Another advantage of DDT is that its deposits are clearly visible long after the e spraying has taken place, which makes supervision of operations more effective. On the other hand,the same properties make it less acceptable to the community. Another disadvantage of DDT is its reduce activity against common household pests.

Areas included in spraying are primarily epidemic-prone in stratum B. In stratum A, spraying should be phased out as soon as correct management and protection of pregnant women are assured. However, in places of tourist attraction, aggregation of labour and refugee camps the spraying should be continued.

In stratum C, spraying should be carried over in cases of impending or ongoing outbreaks.
Because of its relatively short residual action, deltamethrin, which has been adopted in recent years should be sprayed closest to the onset of the rainy season in order for its efficacy to cover major part of the rainy season.

Where the use of DDT becomes is indicated and appropriate, the spraying can start in October-November i.e before the main rainfall when many villages are still accessible for wider coverage.

Larviciding is practicable in few situations, e.g. near artesian wells in stratum A, during periods of low transmission. Small-scale reduction of breeding places may also be helpful in some situations where and when their number is limited. Applicability and cost-efficiency of this measure are subject of applied research.

2.5 Personal Protection

Individual protection against mosquito bites and, especially, use of impregnated mosquito nets may be practicable, however, applied research followed by pilot projects is needed before recommending the large-scale use of this method.

2.6 Control of Epidemics

The past experience indicates that epidemics occur in particular strata and are linked with particular weather conditions. Therefore, prediction of epidemics is possible. From geographical point of view, they mostly occur in strata B and C. In particular areas epidemics occurred at frequent intervals, while others seem not to be affected. It is important to conduct retrospective research to find out the factors responsible for this difference and conditions which lead to such epidemics.

An ideal outcome of the research would be finding few discriminatory indicators that, in concrete Zimbabwean situation, are associated with epidemics. This may be, for example, a particular combination of terrain, pattern of rainfall and/or temperature during a concrete period of the year. Such indicators are not necessarily causally related to malaria, for example, a particular type of vegetation may indicate that the area is epidemic-prone. Use of such indicators, if they are identified, greatly facilitate malaria stratification by allowing using existing thematic maps.

One of such indicators, altitude, is already well known in Zimbabwe and is being used as a tool for malaria stratification. However, use of this indicator alone is probably insufficient.

Prospective studies include monitoring of weather conditions, with special reference to particular anomalies which are known to have been associated with epidemics in the past, and monitoring of epidemiological parameters (incidence of fevers, parasite incidence, etc.). Their significant increase above the normal curve(which should be elaborated on the basis of available information) should be considered a warning signal of an unfolding epidemic.

Epidemic-prone areas should receive insecticidal cover as a matter of priority. Suppression of epidemics when they occur in areas which have received prophylactic spraying calls for urgent spraying.

Preparedness for epidemics includes deployment of stocks of drugs, insecticides and spraying equipment which are to be kept at district level. Besides that, central stocks are created to be moved in stratum C areas (normally malaria transmission free), in case when indications of impending or ongoing epidemics have been perceived. A contingency plan for action in case of an epidemic alert should be prepared for every epidemic-prone area (on a district basis).

2.7 Health Education

The objectives of health education consist in creation of awareness of malaria problem, teaching simple measures which may be undertaken by community and families, making antimalarial activities conducted by the health service system understood by the people in order to solicit their cooperation better.

In order to make health education more effective and efficient, there is need to improve the channels of communicating health education messages using the most appropriate technology, including audiovisual aids.

Content of education is given in Table 13, which is mostly applicable to strata A and B. In anticipated or ongoing epidemics, the same content of health eduction is applicable also to stratum C. Health eduction for travellers which is mentioned in the same table is applicable to strata C only.
In addition, health eduction includes explication of actions of spraying teams in areas under insecticidal spraying.

Table 13
Health education on malaria

Risk groups	Entry points	Contents of education			
		Case management	Individual protection	Community measures	Chemoprophylaxis
Young children	Mothers	+	+		
	Schoolchildren	+	+		
Schoolchildren	Mothers	+	+		
	School teachers	+	+	+	
	Schoolchildren	+	+	+	
Pregnant women	Pregnant women	+	+		+[1]
Adults	Patients	+	+	+	
	Community/opinion leaders	+	+	+	
Travellers[2]	Travellers, patients		+		+

Notes: [1] In stratum A only
[2] In strata C.

The following messages are essential for the public to know:

2.7.1 General Information

- Where malaria is found in the country;
- Seasonality of malaria;
- The major risk groups in the respective strata;

2.7.2 Basic Case Management Messages

- Malaria is curable and is not particularly a severe disease if treated very promptly;
- It is critical to start treatment at first signs of the disease, if necessary, at home;
- It is wise to have a supply of antimalarial at hand, bearing in mind that shelf life of antimalarial is long, or alternatively to know where to obtain them at shortest possible time.

2.7.3 Information on Individual Protection Measures

- The at risk groups should be given protection as a matter of high priority;
- Personal protection measures do not necessarily eliminate the risk of infection, but such a risk is only reduced by such measures;

2.7.4 Information on Conducive Environment for Breeding

- Recognizing the breeding places and identifying the anophiline larvae
- Community action for denying breeding opportunities or destroying them;

2.7.5 Information on Chemoprophylaxis

- Pointing out the major groups at highest risk to take the necessary precautionary measures;
- Following the regimen on chemoprophylaxis meticulously;
- Underlining that chemoprophylaxis does not necessarily prevent infection, but prevents severe disease and death;
- If somebody taking chemoprophylaxis develops symptoms of malaria, she/he must be treated.

- Pointing out that spraying is primarily intended to kill infected mosquitoes (interrupting transmission) and not necessarily to reduce the mosquito population significantly in a particular area;

- If used for spraying the walls and ceiling only, taking the necessary precautionary measures during application, insecticides are relatively safe;
- Insecticides for public health use should not be used for crop protection, because it is better to protect human health first than crops;

2.8 Epidemiologic Surveillance

Epidemiologic surveillance implies monitoring of factors which influence epidemiological trends contrary to expectations and taking corrective measures. Weakness of epidemiologic surveillance lies in the fact that the focus of monitoring has been primarily placed on outcome of epidemiological occurrence, (e.g. morbidity and mortality data)rather than establishing a monitoring mechanism which caters for a comprehensive and continuous epidemiologic process. Thus comprehensive epidemiologic surveillance will explore all the factors which to the occurrence: environmental,socio-economic, climatic, demographical,biological, entomological, parasitological, and of course morbidity and mortality.
A pre-requisite for establishing an effective surveillance is the creation of a National Malaria Unit at the Ministry of Health and Child Welfare and strengthening of epidemiological capabilities at provincial and district levels. This unit is to work in close collaboration with Blair Research Laboratory Institute to provide it with technical support for surveillance strengthening.

The function of the National Malaria Unit in epidemiologic surveillance will be to prepare policies, guidelines and protocols for monitoring progress in surveillance and evaluating its performance as well as providing technical support and guidance in implementation of the tasks assigned to the provinces/districts.
In order to facilitate collection, compilation, storage, and processing of the epidemiological data, health information units will be equipped with appropriate technology, including computers.

At provincial/district level, clinically diagnosed incidence will be collected from the clinicians in clinics, health centres and hospitals, while parasitically confirmed incidence
is to be collected through the laboratories. Besides that, the provincial and district offices will process information from the lower levels, supervise peripheral sentinel posts and facilitate field studies by specialized teams from the central level. they will obtain meteorological information from appropriate agencies and interpret it, in order to sound early warnings on impending or threatening epidemics. At lower levels sentinel posts with laboratory facilities will be established to cover mostly poorly accessible or highly sensitive areas. Information from the sentinel posts will be processed separately from the information from other peripheral institutions.

2.8.1 Early Warning Indicators

For malaria epidemiologic surveillance, not only is it important to collect morbidity and mortality data, but prior to that there is need to collect data on other parameters using indicators such as those discussed above, under 2.5 Control of Epidemics.

2.8.2 Subsequent Warning Indicators

Incidence is one of the subsequent indicators in epidemiologic surveillance. There are two approaches to measurement of the incidence of malaria: on clinical basis and on the basis of a parasitologically confirmed diagnosis. Both have advantages and shortcomings. Clinical incidence provides wide coverage, but individual diagnoses are often unreliable. Therefore, direct comparison of geographical areas is often impossible because the approach to diagnosis may be different in different areas (as it is probably the case in various provinces of Zimbabwe). However, diagnostic criteria in a particular area do not drastically change over years, this can be a fair measurement of trends of malaria in the same location.

Parasitologically confirmed incidence is more reliable (but this is true if supervision and uniformity of laboratory standards are assured), though limited in scope. However, if sampling of the population is representative, even limited coverage may provide meaningful information. Because of that, it would be advantageous to use both approaches taking care of not merge the data from the two sources.

2.8.3 Important Epidemiological Data

The following absolute figures are to be retained:

- number of the population of the area;
- number of clinical cases of malaria diagnosed without parasitological confirmation;
- number of confirmed cases of malaria;
- number of blood slides examined;
- number of positive parasitological results.

From the above variables, it is then possible to develop appropriate malariometric rates as follows:

- CI	Clinical Incidence	(Number of clinically diagnosed cases)/ (population)*1000
- BER	Blood examination Rate	(Number of examined)/ (Population)*1000
- SPR	Slide Positive Rate	(Number of positives)/ (Number examined)*100
- Parasite Incidence		(Number of positives)/ (Population)*1000

Taking into consideration the fact that in the aggregated epidemiological situation of Zimbabwe the peak of malaria incidence and prevalence occur at different age, the rates should be calculated according to age, using the following age grouping: below 1, 1-4, 5-9 10-14, 15 an above. Such grouping allows to identify the priority risk groups to recognise a shift of incidence to older age groups (which is a more sensitive indication of a decrease of the transmission that general incidence) and to detect recent transmission (by observing the group below on year).

Since each of the eight provinces of Zimbabwe stretches over all three malariological strata, the data by province may be misleading. Data should be analyzed by district, and in the future, by strata within each district.

For more meaningful interpretation of the rates based on blood examination, BER should be sufficiently high (about 5% or more per year).

There is no full-proof prescription for interpretation of the dynamics of the above parameters and the ensuing decision-making. However, some standard situations may be recognized.
The following examples illustrate such dynamics as follows:

Behaviour of the Indices	Interpretation
When CI and BER increase PI does not follow	An ongoing epidemic of a febrile disease other than malaria or else Lab diagnosis is not sensitive enough , many malaria cases are missed
When BER is high and PI is low	No good criteria for selection of cases for examination or else Laboratories miss many of malaria cases
Increase in PI in all age groups	An ongoing epidemic of malaria
Increase in PI in adults, mostly in males	Usually a massive importation of malaria or malaria connected with developmental projects
With an adequate ABER in <1 year age group, PI becomes zero	Sharp decrease or interruption of transmission

2.8.4 Monitoring of Severe Cases and Deaths

The goal of the programme being to reduce duration of illness and to minimize incidence of severe and complicated malaria and to reduce mortality due to malaria, the success of the programme will be measured by these trends. Besides that, the age composition of sever cases and the age cut-off point of deaths due to malaria are important indicators of the endemicity: the lower the endemicity the less the proportion of young children among severe and fatal cases.

Monitoring of severe cases as such may be difficult because the indicators (e.g. the proportion of severe cases among all hospitalized cases) depend heavily on the definition of a severe case which may vary from hospital to hospital and from one doctor

to another. Therefore, steps are to be taken to adopt a standard definition of a severe case.

Use of Indicators for Monitoring Progress in Case Management:
As to the indicators of mortality, recording of the overall malaria mortality is usually unreliable: cases of deaths due to malaria are usually under-reported, and the diagnosis of the cause of death is often dubious. Hospital records are more reliable.
The following rates should be analyzed from time to time:
- hospital mortality from malaria per population of the catchment area in a given period of time;
- case fatality rate among all hospitalized malaria cases in a given period of time;
- case fatality rate of patients with severe malaria in a given period of time.

Each of these indicators is more or less biased. Although deaths occur in hospitals, they depend mostly on the quality of case management at the periphery and in the families and also on the criteria of admission of in-patients to the hospital. Besides that, much depends on the definition of the severe case. If the definition is very broad, mild cases dilute the group thus decreasing the fatality in severe malaria.

Therefore, to make meaningful conclusions, all malaria deaths occurring in the hospitals should be investigated in order to identify the possible primary cause of the fatal outcome at various levels of case management which may fall into the following broad categories:

A. Before arriving at peripheral health institution:
   - inadequate home treatment or at rudimentary health care post

B. Before arrival at a referral centre
   - inadequate case management at the peripheral level (the most common error is to refer a patient without starting antimalarial treatment);

C. Before death
   - inadequate case management at the hospital(failure to detect the parasites by the laboratory, failure to appraise the seriousness of the illness, absence of parenteral drugs, excessive amount of fluids given in perfusion are common causes); and

   - resistance of the parasite to antimalarial.

Indicators for Monitoring Progress in Malaria in Pregnancy
Since chemoprophylaxis is one of the major strategies, its results should be closely monitored. The main expected results will be determined using the following rates:
- coverage of use of chemoprophylaxis among pregnant women attending ANC (number of women attending ANC and taking chemoprophylaxis divided by the total number

of antenatal attendance times 100 in a given period of time);
- number of miscarriages attributed to malaria divided by the number of all abortions times 100 in a given period of time;
- number of babies born with low birth weight,whose mothers had history of malaria during pregnancy divided by the number of all babies born withe low birth weight times a thousand in a given period of time.

2.8.5 Monitoring Meteorological Trends (Early Warning)

The interest in meteorological observations, is in its providing clues of early warning on epidemics. Mainly two meteorological factors are of epidemiological significance: temperature and rainfall.

The life of the malaria parasite in the body of a mosquito is very much dependent on the surrounding ambient. The P. falciparum sporozoite are able to develop at the average temperature above 18 degrees C and soon. If the temperatures fall below that level they die rapidly. With average daily temperatures between 18 and 20 degrees C, transmission is possible but cannot be intensive (extrinsic cycle, taking about a month). Monitoring of temperature for establishing the level of transmission is indicated only at fringes of the area of distribution of malaria in places where temperatures rise above 20 degrees, when the usual mean temperatures fall below this level for extended periods of time. Likewise, where temperatures are usually beyond that level, one should assume that transmission will reduce if temperatures fall below it for extended period of time. The important moments to mark are those in which the daily average temperatures surpass the threshold of 18 degrees C in a constant manner, when an effective infectivity of vectors becomes possible. In order to determine the duration of the development of the sporozoite it is important to establish the date of the first infections in humans, and then deduce from the level of the daily average temperatures. The example of the way of estimating it, is given in Annex 8. The first fresh cases of malaria are due to appear 7 to 10 days after maturation of the sporozoite.

It appears that it is not quite clear which deviations from the normal rainfall pattern lead to epidemics in Zimbabwe. It seems that both sufficient and very heavy rainfall may inhibit the transmission. Moreover, the impact of rainfall will also depend on the temperatures. Although it is presently difficult to use this information forecasting the epidemics directly, accumulation of data is necessary to develop methods of predicting epidemics in future. It may be more cost-effective and cost-efficient to make use of the existing meteorological facilities and data than relying upon makeshift observatories.

When the system of early warning about the danger of epidemics is fully established, it will trigger the implementation of the contingency plan for the prevention of epidemics.

2.8.6 Monitoring Parasite Resistance to Antimalarials

This aspect of monitoring may start as part of the applied research programme, and then later to be handed to the epidemiologic surveillance system and to become a routine activity. Selection of the areas where tests will be done will depend on the information regarding therapeutic failures. There is need to identify sentinel hospitals, to start with, which will record the number of malaria cases which have received treatment and the number of therapeutic failures as defined above. If an unusual increase of treatment failures is reported, a team from the central or provincial level will proceed to conduct comprehensive testing. In vivo tests will be conducted in clinical cases rather than in carriers.

2.8.7 Monitoring Parameters of Vector Control

Data on coverage by insecticide spraying of human dwellings and other structures separately will be compiled according to the villages, routinely. Measurements of some of the parameters may be started as part of applied research, then later it can become a routine activity. Such parameters include chemical residual activity, biological/entomological - measurements of mosquito population densities in areas of seasonal malaria where they stay negligibly small over long periods of time, mosquito resistance to insecticides, and human behaviourial ones, pertaining to community perceptions and acceptance of spraying, replastering, etc.

Although the threshold level of mosquito densities needed to trigger an outbreak is presently unknown, the accumulation of data and experience will contribute to the development of method of forecasting epidemics.

2.9 Training of Health Workers

In order to revamp the National Malaria Control Programme during the 5-Year Plan period, training, retraining as well as reorientation of health workers in various aspects where the needs have been identified will be pursued. The categories of trainees, as well as the content of training areas and courses are presented in Table 14.

Table 14
Training

Sl No	Name of the course	Trainees	Responsible	Duration (working days)	Integration with other courses
1	Training of trainers	District Health Officers	Ministry of Health	10	Non
2	Case management	Physicians	Ministry of Health	3	Non
3	Severe and complicated malaria	Physicians	Ministry of Health	5	Non
4	Case management	Nurses from peripheral health centres/clinics	District Health Officers	3	ARI, CDD
5	Case management	Village community workers	District Health Officers	3	ARI, CDD
6	Case management	School teachers	District Health Officers	2	CDD
7	Epidemiological techniques	Environmental health officers/assistants	Ministry of Health	15	Epidemiology
8	Community protection measures	Village community workers	District Health Officers	3	Sanitation
9	Community protection measures	School teachers	District Health Officers	2	Sanitation
10	Lab diagnosis of malaria	Lab technicians	Blair Research Institute	15	Non
11	Lab quality control	Lab supervisors	Blair Research Institute	5	Non
12	Research methodology	Research workers	Blair Research Institute	5+5	Non

2.10 Applied Research

In order to strengthen Malaria Control, applied research is vital to provide the answers which back-up effective implementation.

The present knowledge on the epidemiology of malaria in Zimbabwe does not allow to answer a number of elementary questions which makes selection of activities difficult, establishment of quantified targets impossible and monitoring of progress problematic. Therefore, a number of particular applied research activities should be conducted at the early stages of the implementation plan in order to form a sound foundation for cost-effective control, surveillance and evaluation.

Areas of research which are unlikely to help decision making, such as serological profile of the population, or those which are unlikely to provide results in the nearest future such as some studies on local medicinal plants have not been included.

Priority is being given to the studies which may fill lacunae in the knowledge of the current epidemiological situation. Broadly, this type of stratification will facilitate the identification of areas and groups of population which require special attention and provide indicators giving allowance for conducting malariologic classification of the areas without conducting field population surveys which consume relatively much of the meagre resources allocated for malaria control. For example, while altimetry is, in Zimbabwe, one of those indicators which allows to predict the malaria status of a particular area, there is need for more precise information through research in order to identify the specific characteristics of particular areas and people for focused
malaria control.

Some of the research activities mentioned in Table 15 are to be incorporated into routine activities of the programme in the course of time.
The essentials of applied research will focus on the following three aspects, given in Table 15 as follows:

2.10.1 Baseline Information

There is baseline information needed to enable the selection of cost-effective operational control methods, setting up quantifiable targets, and evaluation of progress.

2.10.2 Impact Assessment

It is likewise important to assess the impact of the programme on the health of the people, whether the control operations are minimizing the severity of the disease, reducing the attendance to health facilities due to malaria, or other wise.

2.10.3 Trend Assessment

There is need to identify the negative trends which can jeopardize the efficiency and effectiveness of the control operations.

Table 15
Main areas of applied research

Area	Objectives		
	A. Baseline	B. Impact	C. Trends
Parasite	▸Effectiveness of chloroquine *vs* pyrimethamine/dapsone in chemoprophylaxis in pregnancy		▸Monitoring drug resistance (later to become part of routine surveillance)
Vector	▸Vector behaviour ▸Species identification ▸Role in transmission ▸Geographical distribution ▸Search for alternative methods for vector control	▸Monitoring mosquito densities (later to become part of routine surveillance) ▸Changes in species composition, bionomics and behaviour of vectors	▸Monitoring duration of residual action and of resistance to insecticides (later to become part of routine surveillance)
Epidemiology	▸Stratification ▸Selection of appropriate measures for each stratum	▸Effectiveness of antimalaria measures in various strata. ▸Clinico-epidemiological profile of malaria in various strata ▸Morbidity and mortality studies	▸Development of methods of early forecast of epidemics ▸Monitoring menace of epidemics (later to become part of routine surveillance)
Socio-anthropology	▸Knowledge, attitudes, practices concerning: →malaria diagnosis; →treatment; →insecticide spraying; →protective behaviour. in the groups of: →population; →treatment providers; →vector control workers. ▸Identification of ways to influence human behaviour vis-à-vis malaria	▸Socio-economic effects of malaria	▸Monitoring of changes of behaviour vis-à-vis malaria and its control

SECTION IV - PROGRAMME MANAGEMENT AND SUPPORT

1. ROLE AND FUNCTION AT CENTRAL LEVEL

The National Malaria Control Coordinating Unit at the Ministry of Health and Child Welfare shall be responsible for the coordination of policies, guidelines and activities related to malaria control with other departments in the Ministry of Health and Child Welfare and other sectors as well as with the provinces by providing technical support. The Unit will be headed by an Epidemiologist or with public health equivalent qualification as well as clinical experience in malaria control, capable of providing direction in the following tasks expected of the Unit. His/her functions will be strengthened by an entomologist, environmental health officer, statistician, apart from skilled and experienced administrative and secretarial support.

The function of the Unit are:

1.1 To consolidate and to analyze epidemiological information;

1.2 To provide national guidance on implementation of the Programme and epidemiologic surveillance support to the provinces;

1.3 To mobilize national and international resources for malaria control;

1.4 To plan malaria control operations at the national level

1.5 To support the provinces in planning and organization of malaria control operations;

1.6 To monitor implementation and organize evaluation of malaria control activities of national significance and interest;

1.7 To make recommendations to the policy makers regarding implementation of the National Malaria Control Programme;

1.8 To prepare periodic, annual and 5-Year Plan terminal reports on the National Malaria Control Programme;

1.9 To organize and conduct training for Malaria Control;

1.10 To liaise with various departments/units, institution and sectors regarding implementation of malaria control activities;

The National Malaria Control Unit will be responsible for responding to requests for the supply of insecticides, spraying equipment and ensure a contingency stock of antimalarials is maintained for responding to epidemics.

Table 16
Steps for the implementation of the strategies

STRATEGIES and STEPS	Year 1	Year 2	Year 3	Year 4	Year 5
0. GENERAL					
Adoption of the Policy Declaration	+				
Holding National seminar on malaria	+				
Adoption of the National Malaria Control Plan	+				
1. CASE MANAGEMENT					
Adoption of the National Drug Policy	+				
Applied research: drug sensitivity studies	+	+	+[1]		
Review of the National Drug Policy			+		
Standardization of the diagnosis of malaria	+				+
Establishing of quality control for antimalarial drugs		+			
Developing a drug supply system through revolving funds		+			
Training of field staff (case management)	+	+	+	+	+
Adoption/review of guidelines for laboratories	+				+
Training/retraining of lab supervisors	+			+	
Training of lab technicians		+		+	

STRATEGIES and STEPS	Year 1	Year 2	Year 3	Year 4	Year 5
Supply of microscopes	+	+	+	+	+
Establishment of a system for laboratory quality control		+			
2. CHEMOPROPHYLAXIS IN PREGNANCY					
Applied research on chemoprophylaxis	+	+			
Adoption/review of guidelines		+		+	
Institution of chemoprophylaxis		+			
3. CHEMOPROPHYLAXIS IN TRAVELLERS					
Adoption of guidelines	+				
Creation and distribution of materials for doctors sensitization and patients education		+			
4. VECTOR CONTROL					
Supply of spraying equipment		+			+
Applied research: studies on the vectors bionomics	+		+		+
Applied research: response of the vectors to insecticides	+	+	+[1)]		
Applied research: use of impregnated bednets		+	+		

STRATEGIES and STEPS	Year 1	Year 2	Year 3	Year 4	Year 5
Applied research: alternative methods of vector control				+	+
Training in entomological techniques for environment health officers			+		+
5. CONTROL OF EPIDEMICS					
Applied research: forecast of epidemics		+			+
Creating of the central stock of drugs and equipment	+	+			
Establishment of an early warning system			+		
6. HEALTH EDUCATION					
Applied research: KAP studies	+			+	
Publication of health education materials		+			+
Supply of audio-visual equipment		+[2]		+[3]	
7. MANAGEMENT AND SURVEILLANCE					
Creating of malaria unit at the central level	+				
Supply of informatic equipment	+[2]		+[3]		
Training in use of informatic equipment			+[3]		
Developing of yearly supervision and management plans	+	+	+	+	+

STRATEGIES and STEPS	Year 1	Year 2	Year 3	Year 4	Year 5
Developing of systems for local participation and management at the periphery		+			
Establishment of the surveillance system		+			
Designing and printing of the record forms	+				
Training of the environment health officers in epidemiology		+			
Supply of vehicles	+[2]	+[3]			
Applied research: stratification	+	+			
Applied research: morbidity and mortality					
Handing over of the monitoring of drug sensitivity to the surveillance system			+		
Handing over of the monitoring of vectors to the surveillance system			+		
Beginning of the dissemination of information through an epidemiological bulletin			+		
8. TRAINING (see also under items 1,4,7,9)					
Establishing the training programme	+				
Development of training modules	+	+			
9. APPLIED RESEARCH (see also under items 1,2,4,5,6)					
Establishing applied research programme	+				
Training in applied research methodology		+			

NOTES: [1] handed over to the surveillance system [2] at the central level [3] at the district level

Blair Research Institute will continue to play an important role in malaria control activities. Its main responsibilities will be:

- To conduct applied research on malaria, following the plans outlined in the Plan as well as those which will be identified as priority areas in future;
- To participate in or conduct training of health workers in applied research and laboratory diagnosis;
- To provide technical support for problem-solving in its areas of competence and jurisdiction in malaria control;
- To act as a central laboratory for epidemiological surveillance;

The existing malaria task force, including representatives of various units/department of the Ministry of Health and Child Welfare, experts from teaching and research institutions, representatives of other sectors and non-governmental organizations will continue to function under the guidance of the National Malaria Control Unit.

2. IMPLEMENTATION AT PROVINCIAL LEVELS

At provincial levels, malaria control will be fully integrated within the primary health care system. Malaria control will be incorporated into the existing committees responsible for disease control, to include support by representatives from administration, medical professionals, representatives of other sectors, non-governmental organization and the private sector.

SECTION V - IMPLEMENTATION OF MALARIA CONTROL ACTIVITIES

Implementation of the 5-Year Plan for the National Malaria Control Programme is outlined in Table 16. Since applied research and training provide pre-requisite for the implementation of other activities, they are included under the corresponding topic and are not kept together.

Bearing in mind that research activities pertaining to drug sensitivity and vector control are to be converted into routine surveillance activities, they will be carried out as such only during the first half of the 5-Year period.

The major areas of implementation in the 5-Year period are outlined under the following categories:

1. Case Management;
2. Chemotherapy in Pregnancy;
3. Chemoprophylaxis for travellers from non-malarious areas;
4. Vector Control;
5. Control of Epidemics;
6. Health Education;
7. Management and Surveillance;
8. Training of Health Workers;
9. Applied Research;

SECTION VI - TOTAL BUDGET FOR MALARIA CONTROL IN ZIMBABWE

The Government of Zimbabwe will continue to support the National Malaria Control Programme at the present level of expenditure. However, for strengthening of the programme, external assistance will be required. The allocation of financial resources for the implementation of the National Malaria Control Programme for in the 5-Year Plan is as follows:

1. For orientation on National Budget for Malaria Control Programme see ANNEX 7. Because of combined budget and integrated approach for disease control, malaria inclusive, both at Head Office and Provinces, it is difficult to provide breakdown of following the single items:

Item	Amount (US $)
Salaries, Remunerations, Subsistence of the Health Workers	
Administrative Costs	
Procurement of Insecticides	
Procurement of Laboratory Equipment and supplies	
Hospital Costs	
Procurement of Stationery	
Purchase of Drugs	
Purchase of Fuel	
* Maintenance of Vehicles and procurement of spare parts	

2. External Support Budget

Item	Amount (US $)
Technical Staff Support	260,000.00
Office, Technical and Radio Communication Equipment:	
Central Level	41,100.00
Provincial Level	123,800.00
Public Health Education Equipment, Training and Publications	44,000.00
Transport for Surveillance and Vector Control Operations:	
Central Level	112,500.00
Provincial Level	1,317,900.00
Training of Health Cadres	242,000.00
Spraying Equipment, Insecticides and Protective Gear	1,276,500.00
Laboratory Equipment	182,850.00
Applied Research	315,000.00
Surveillance and Evaluation	80,000.00
Grand total	3,842,050.00
Contingency (10%)	384,205.00
WHO Administrative Costs	499,466.50
GREAT GRAND TOTAL	4,725,721.50

Table 18:

5 YEAR BUDGET FOR EXTERNAL SUPPORT
(COSTS IN US $)

ITEMS	TOTAL COST	SUB-TOTAL YEAR 1 (1994)	SUB-TOTAL YEAR 2 (1995)	SUB-TOTAL YEAR 3 (1996)	SUB-TOTAL YEAR 4 (1997)	SUB-TOTAL YEAR 5 (1998)
1. TECHNICAL STAFF SUPPORT	260 000	52 000	52 000	52 000	52 000	-
2. OFFICE,TECHNICAL & RADIO COMMUNICATION EQUIPMENT: a) CENTRAL LEVEL b) PROVINCIAL LEVEL	41 100 123 800	34 800 48 000	12 000 5 000	4 700 62 600	3 800 6 600	1 200 1 600
3. PUBLIC HEALTH EDUCATION EQUIPMENT, TRAINING AND PUBLICATIONS	44 000	12 000	22 000	-	-	10 000
4. TRANSPORT FOR SURVEILLANCE & VECTOR CONTROL OPERATIONS a) CENTRAL LEVEL b) PROVINCIAL LEVEL	122 500 1 317 900	58 500 725 380	13 500 715 380	13 500 34 380	13 500 34 380	13 500 34 380
5. TRAINING OF HEALTH CADRES	242 000	65 000	110 000	40 000	85 000	50 000
6. SPRAYING EQUIPMENT INSECTICIDES & PROTECTIVE GEAR	1 276 500	501 000	107 500	477 000	95 500	95 000
7. LABORATORY EQUIPMENT	182 850	552 200	44 850	27 600	27 000	27 000
8. APPLIED RESEARCH	315 000	91 000	79 000	40 000	50 000	55 000
9. SURVEILLANCE & EVALUATION	80 000	13 000	13 500	14 500	12 500	26 000
10.GRAND TOTAL	3,842,050.00	2,047,536.00	1,127,235.00	716,084.00	320,983.00	246,982.00
11.CONTINGENCY (10%)	384 205	204 758.60	112 723.5	71 608.4	32 098.3	24 698.2
12.WHO ADMINISTRATIVE COSTS	499 466.5	266 186.18	146 540.55	93 090.92	41 727.79	32 107.66
13.GREAT GRAND TOTAL	4 725 721.5	2 518 530.7	1 386 499.05	880 783.32	394 809.09	303 787.86

LIST OF ANNEXES

MALARIOMETRIC RATES

BER	Blood Examination Rate (for any period)	(Number of examined)/(Population)*100
ABER	Blood Examination Rate (annual)	Same as above
SPR	Slide Positivity Rate	(Number of positives)/(Number of examined)*100
PI	Parasite Incidence (for any period)	(Number of positives)/(Population)*1000
API	Parasite Incidence (annual)	Same as above
PFG%	Percentage of gametocytes among P. *falciparum* cases	(Number of cases with P. *falciparum* gametocytes)/(Number of P. *falciparum* cases)*100

Annex 2.

AGE STRUCTURE OF THE POPULATION OF ZIMBABWE
(1991 estimate; source: Ministry of Health, 1992)

Age	Males	Females	Total
below 1	177666	186930	364596
1-4	691524	709650	1401174
5-9	814034	834101	1648135
10-14	699094	692621	1391715
15-19	517988	550448	1068436
20-24	397502	489049	886551
25-29	348100	390233	738333
30-34	253820	271288	525108
35-39	204786	220967	425753
40-44	197933	182318	380251
45-49	157868	142807	300675
50-54	149857	119350	269207
55-59	92945	81855	174800
60-64	100482	82444	182926
65-69	50885	50505	101390
70-74	40450	39621	80071
75 & above	49742	57318	107060
Non spec.	10905	17912	28817
Total	4955581	5119417	10074998

A COMPARISON BETWEEN MICROSCOPICALLY CONFIRMED AND CLINICAL MALARIA

Province-wise distributions of indices characterizing microscopically confirmed cases of malaria (Annual Parasite Incidence, Table 7) and indices of clinical malaria (Index of Hospitalized Cases of Malaria, Lethality of Malaria and Hospital Mortality Due to Malaria, Table 8) have been compared using Spearman's rank correlation test.

For this, the eight provinces of Zimbabwe have been ranked according to the values of each of the three coefficients repeated in three age groups, and the obtained 12 sets have been compared with each other, thus obtaining 12*11=132 correlation coefficients *(R)*. Selected comparisons are presented in the Table.

Table
Comparison of distribution of selected indices province-wise

Distributions compared	*R*	Significance[1]
API[2] below 1 *vs* API 1-4 years	0.970	**
API below 1 *vs* API >=5 years	0.685	*
API 1-4 *vs* API >=5 years	0.690	*
IHCM[3] below 1 *vs* IHCM 1-4 years	0.833	**
IHCM below 1 *vs* IHCM >=5 years	0.524	NS
IHCM 1-4 *vs* IHCM >=5 years	0.560	NS
IHCM *vs* API below 1	-0.280	NS
IHCM *vs* API 1-4 years	-0.095	NS
IHCM *vs* API >=5 years	0,375	NS
IHCM *vs* lethality below 1	-0.476	NS
IHCM *vs* lethality 1-4 years	-0.571	NS
IHCM *vs* lethality >=5 years	0.440	NS

[1] Significance level for 8 pairs of observations (two-tailed test):
** $R > |0.833|$, significant at 99% level
* $|0.833| > R > |0.643|$, significant at 95% level
NS $R < |0.643|$, non-significant

[2] API is the Annual Parasite Incidence

[3] IHCM is the Incidence of hospitalized cases of malaria

The observations may be summarized as follows:

(a) APIs in various age groups are strongly and positively correlated between themselves: higher is the microscopically confirmed incidence in one age group, higher it is in other groups;

(b) this is not the case in hospitalized incidence, except a high correlation between the groups of below 1 and 1-5;

(c) microscopically confirmed incidence does not correlate with the frequency of hospitalization for malaria in any of the age groups;

(d) frequency of hospitalization for malaria and hospital malaria lethality do not correlate.

Such disagreements between the rates which are supposed to measure the same phenomenon, i.e. magnitude of malaria may be explained in two ways:

(i) the groups of those who were examined microscopically and of those who were subjected to hospitalization have been drawn from different strata of population. (there is no evidence in favour of this hypothesis);

(ii) a more plausible explanation is that there are many cases of non-malaria among so-called clinical malaria cases. In addition, criteria for diagnosis (or misdiagnosis) of malaria are not the same in young children and in the group above 5 years of age; furthermore, they are probably not the same in different provinces.

LABORATORY PROCEDURE

Blood slide: only thick films are to be collected and examined.

Staining: Giemsa stain, dissolved in the phosphate buffer solution at pH = 7.0-7.2.

Number of fields: examination of 100 microscopic fields (lens x100, eyepiece x7) using mechanic stage.

Registration:
- in case of *Plasmodium falciparum*: the parasite species and stages (asexual, gametocytes or both);
- in other species: the parasite species only;
- in all cases: parasite densities (PD).

Parasite densities are to be recorded using a semi-quantitative logarithmic scale (Table 1):

Table 1
A system to record parasite densities

Class	Number of parasites	Visual impression	Clinical interpretation
5+	>100 per field	Parasites so many that it is difficult to count them	Severe malaria, a fatal outcome is very likely
4+	10-100 per field	Parasites are abundant, but may be counted	Severe malaria, a fatal outcome is likely in non-immunes
3+	1-10 per field	Parasites in every field	Clear symptoms in non-immunes, may be silent in semi-immunes
2+	1-10 per 10 fields	Parasites not difficult to find, but many fields are without parasites	Symptoms usually present in non-immunes, and absent in semi-immunes
1+	1-10 per 100 fields	Parasites are scanty	Manifestations only in few non-immunes

Parasite densities should be recorded for every species, and separately for asexual stages and gametocytes in the case of *P. falciparum*, e.g.:

P. falciparum: asexual 3+
gametocytes 1+

Parasite densities are to be used:

- for clinical assessment of individual cases;

- for epidemiological characterization (average parasite density;

- for quality control of lab diagnosis.

Quality control is done at the provincial laboratory in the blind way, the technician not knowing the results of the primary examination. Samples from provincial laboratories are examined at the central laboratory at the Blair Institute. 10% of the negative and 50-100% of positives are to be cross-checked. They are selected using the last digit of the serial number of the slide.

Returns from the cross-checking laboratory must contain the following information:

- number of slides received;

- number of slides impossible to re-examine;

- number of slides cross-checked

  out of which:

  -- negative remaining negative;

  -- negative becoming positive, with PD for each slide;

  -- positive becoming negative, with PD according to the primary examination;

  -- positive remaining positive, with concordant species, stage, and PD (± 1 score: e.g. 2+ and 3+ considered to be non-discrepant)

  -- discrepant slides, with an indication of primary and secondary diagnoses.

Comments are also given on the quality of examination and on the possible reasons for poor quality (e.g. wrong pH, overstaining, etc.), as well as an advice how to improve the quality. In case of a high and consistent discrepancy rate or a consistently poor quality of staining, an on the spot check is to be done. For this, a senior lab technician capable to solve problems with staining and to make simple repair of microscopes is designated.

Typical examples of situations, in which the information on parasite densities may be helpful for improving the quality of the diagnosis, are as follows (Table 2):

Table 2
Using parasite densities in quality checks

Symptoms	Diagnosis	Corrective actions
1. Many false positive results, mostly with 1+ densities	The microscopist takes for parasites various bacteria, dust particles, etc.	- check the quality of staining; - check the quality of the microscope, clean and repair, if needed; - re-examine the slides with the technician
2. PD as reported by the microscopist, are systematically lower than at the cross-check	The microscopist recognize only few typical parasites	- re-examine the slides with the technician
3. Many false negative results in slides with low PD; reported PD accurate, when they are high	The microscopist does not examine the prescribed number of fields	- find out why this happens; if workload is too high (more than 50 slides a day), diminish it, at the expense of the slides of a lesser priority

ANNEX 5

RECOMMENDED CHEMOPROPHYLAXIS AND CHEMOTHERAPY FOR MALARIA IN ZIMBABWE

1. POLICY ON CHEMOPROPHYLAXIS FOR MALARIA

1.1 Groups at High Risk

Chemoprophylaxis for malaria is recommended for the following categories of people in Zimbabwe:

- all persons travelling from non-malaria affected area to a malaria affected area;
- pregnant women in endemic areas; and
- persons with sickle cell anaemia or splenectomy.

1.2 Drugs used for chemoprophylaxis

1.2.1 Pyrimethamine/Dapsone

Pyrimethamine with dapsone is the drug of choice for malaria prophylaxis in Zimbabwe.

Appropriate Usage

It can be safely used in children > 1 year. It may be used in the second and third trimester of pregnancy and in lactation with folic acid (5mg,once) supplementation daily.

Reason for Changing to other Drugs

If allergic reaction develops or there is unacceptable haemolysis with pyrimethamine, then substitute chloroquine with proguanil.

Dosages of Pyrimethamine with Dapsone for Prophylaxis and When to Take

Pyrimethamine with Dapsone (O) is available as tablets containing 12.5 mg pyrimethamine and 100mg Dapsone. It is to be taken regularly on the same day each week, starting one week before entering the malaria affected area, and continuing until 4 weeks after leaving the area. See Table 1.2.1 for age-specific dosages.

Contraindications for Using Pyrimethamine Dapsone

Pyrimethamine is not recommended for children under 1 year of age and in the first trimester of pregnancy.

1.2.2 Chloroquine

Chloroquine is the alternative drug for chemoprophylaxis in case of contraindications for the drug of choice.

Appropriate Usage

It is administered with proguanil.

Table 1.2.1 Pyrimethamine with Dapsone Dosages

Age (a)	Weight	Weekly dosage
1 - 5 years	10 - 19 kg	¼ tablet weekly
6 - 11 years	20 - 39 kg	½ tablet weekly
Adults	Above 40 kg	1 tablet weekly

Note: (a) Weight is a better guide than age for children.

For those intolerant to dapsone or pyrimethamine:

C *chloroquine* (O)
PLUS
B *proguanil* (O)

Chloroquine is available as tablets containing 150 mg base, or a syrup containing 50 mg base in 5 ml. To be taken once a week, on the same day each week, starting 1 week before entering the malarial area, and continuing for 4 weeks after leaving the area.

Dosages of Chloroquine for chemoprophylaxis
Chloroquine is available as tablets containing 150mg base or a syrup containing 50mg base in 5 ml. It is to be taken once a week, on the same day each week, starting 1 week, before entering the malaria area and continuing for 4 weeks after leaving the area. See Table 1.2.2 for age-specific chloroquine dosages.

1.2.3 Proguanil :-
Appropriate Usage
It is administered with chloroquine.
Dosages of Proguanil for Prophylaxis
Proguanil is available as tablets(100mg). For paediatric application a tablet is crushed. It is to be taken daily starting 24 hours before entering the malaria affected area best after meals.

2. POLICY ON TREATMENT FOR MALARIA

Almost all the malaria in Zimbabwe is caused by P. falciparum. Only a few cases of malaria are due to P.vivax, P. ovale and P. malariae. Complications occur only with P. falciparum and usually in non-immunes: young children, pregnant women, debilitated persons, and malaria non-affected dwellers or relocated persons, such as refugees, security forces and road building teams, etc.

The incubation period for the symptoms and signs of malaria to appear is about 9 - 15 days, but it may be prolonged if drug prophylaxis was taken or self-medication was administered.

2.1 Chloroquine

2.1.1 Dosages for Uncomplicated Malaria, Chloroquine Sensitive Cases

The following regimen applies to uncomplicated cases of malaria and those in which the parasite is sensitive to chloroquine.

For Adults:
The total oral dosage divided into four intervals dosages is 10 tablets (1.5 G), taken as follows:
4 tablets (600mg base) as an initial dose, followed by 2 tablets (300mg base) 6 hours later, then
2 tablets (300mg base) daily for 2 days.

For Children:
The total oral dosage divided into four intervals is 25mg base/kg body weight or 2.5ml syrup/kg body weight, given at the similar intervals as for adults. The initial dose is 10mg base or 1ml syrup/kg body weight.

Table 1.2.2

Chloroquine Dosages

Age	Weekly Dosage
Under 1 year	50 mg (1/3 tablet or 5 ml)
1 - 4 years	75 mg (1/2 tablet or 7.5 ml)
5 - 8 years	150 mg (1 tablet or 15 ml)
9 - 12 years	200 mg (1 1/2 tablets or 20 ml)
Over 12 years	300 mg (2 tablets or 30 ml)

Proguanil is only available as tablet (100mg); crush for paediatric use. To be taken daily starting 24 hours before entering the malarial area and continuing until 4 weeks after leaving the area. Best taken after food.

Table 1.2.3

Proguanil Dosages

Age	Weekly Dosage
Under 1 year	25 mg (1/4 tablet)
1 - 4 years	50 mg (1/2 tablet)
5 - 8 years	100 mg (1 tablet)
9 - 14 years	150 mg (1 1/2 tablets)
Adults	200 mg (2 tablets)

2.1.2 Drugs and Dosages for Uncomplicated, Chloroquine resistant

If the slide is positive and there are no improvements after 24-48 hours on chloroquine, or if the patient's condition is deteriorating, treat the patient with: Sulfadoxine + pyrimethamine (O) available as tablet containing sulfadoxine 500mg and pyrimethamine 25mg per tablet (Fansidar).

For Adults
Weight > 60 kg 3 tablets in a single dose

For Children

0-4 years	1/2 tablet in a single dose
5-6 years	1 tablet in a single dose
7-9 years	1 1/2 tablets in a single dose
Over 9 years, but <60kg body weight	2 tablets in a single dose

Adverse effects!
Though rare but it can cause agranulocytosis, Stevens-Johnson Syndrome.

Intolerance or Deterioration !
If treatment with sulfadoxine/pyrimethamine after 24-48 hours, or if the patient's condition is deteriorating, and still the blood slide is positive, a patient is treated with quinine + doxycycline.

Quinine(O)
Dosages:
For Adults: 600mg(salt), every 8 hours for 7 days
For Children: 10mg/kg/dose (salt), same interval as adults

P L U S

Doxycycline(O)
Dosages:
For Adults: 100mg once daily for 7 days, at the same time as quinine course
For Children > 8 years: 2mg/kg/day

Adverse Effects !
Even at those dosages, quinine can cause headache, mental confusion, nausea, tinnitus, tremors, abdominal pain, rashes, visual disturbances, including temporary blindness). Hypersensitivity reactions may occur, though rarely.

Contraindications!
Doxycycline is contraindicated in children <8 years and pregnant women.

Alternative to doxycycline
Sulfadoxine + pyrimethamine (O) as a single dose (as above in uncomplicated malaria) at the end of quinine course.

Further considerations!
If the condition is deteriorating, consider IV quinine instead of oral (see under "complicated malaria").

2.1.3 Malaria due to P.vivax/P.ovale
In cases of P.vivax and P. ovale, the chloroquine course should be followed by primaquine to eradicate persistent liver forms.
Primaquine (O)

Dosages:

For Adults: 15mg base, once daily for 14 days

For Children: 0.25mg/kg base

Precautions !
Where possible patients should be screened first for glucose-6-phosphate dehydrogenase (G6PD) deficiency.
For G6PD deficient adults, reduce the dosage as follows:
Primaquine (O) 30mg base once a week for 8 weeks.

2.1.4 Complicated Malaria
A case of malaria is considered under this categories if it presents as cerebral malaria or if there are any of the following signs and symptoms:
Severe haemolytic anaemia; renal failure; severe haemoglobinuria or hyperparasitaemia (2% or grater in non-immune; or parasites > 100/field in thick smear).

Under assumption that all cases are chloroquine resistant:

Drug Treatment:
Quinine (IV infusion) 10mg/kg diluted in 500mls of dextrose (5%) given over 4 hours. Repeat every 8 hours until the patient can swallow (up to 4 doses), then give

Quinine(O) every 8 hours to complete 7 days treatment.

Precaution !
Direct IV injection should NOT be given. IM injection is less satisfactory, but may be used to initiate therapy when facilities for IV infusion are NOT available.
Hypoglycaemia may occur after IV administration of quinine.

In addition:
Doxycycline (O) 100mg once daily for 7 days during quinine course

OR pyrimethamine + sulfadoxine 3 tablets as a single dose at the end of treatment.

A method for computation of the duration of development of *P. falciparum*

This method developed by S.D.Moshkovsky (1944) allows to calculate the number of days required for the development of sporozoites of malaria parasites in a mosquito at given average daily temperatures (ADT).

Information required: ADT as recorded by a meteorologic station. An approximation may be taken by dividing the sum of minimum and maximum temperatures by two.

Development and survival of *P. falciparum* in a mosquito is possible when ADT are consistently above 18°.

For every day of a particular period of time, the difference between the ADT and 16° is calculated. The results are summed up. By the moment when the sum reaches or surpasses 111, the development of *P. falciparum* is completed, and henceforth the mosquito can transmit the infection for the rest of its life.

An example is given below:

Date	ADT	Difference	Sum	
01.09	18	2	2	
02.09	19	3	5	
03.09	21	5	10	
04.09	22	6	16	
05.09	23	7	23	
06.09	24	8	31	
07.09	23	7	38	
08.09	25	9	47	
09.09	26	10	57	
10.09	27	11	68	
11.09	25	9	77	
12.09	24	8	85	
13.09	23	7	92	
14.09	25	9	101	
15.09	24	8	109	
16.09	25	9	118	118 > 111

CONCLUSION:
gametocytes ingested by a mosquito on 1 September developed into infective sporozoites by 16 September.

ANNEX

NATIONAL MALARIA CONTROL PROGRAMME, ZIMBABWE

Budget for 1992/93 financial year (July-June)
(prices in Z$)[1]

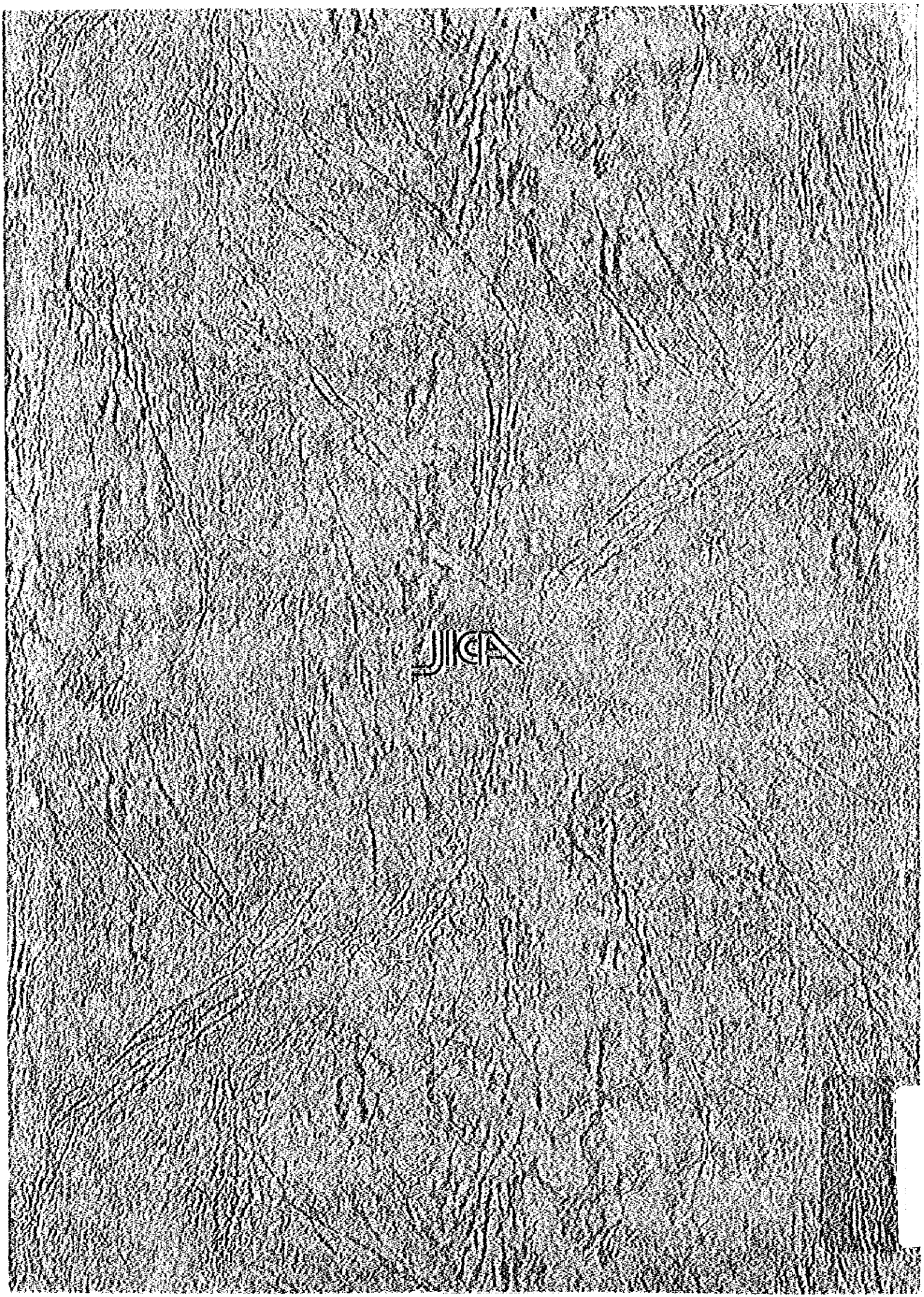
Item	Qty	Unit cost	Total cost
Cislin (litres)	20,360	149.00	2,953,530
Icon (kg)	1,680	304.00	526,096
SUBTOTAL: Insecticides			3,479,626
Microscopes	10	6,065.80	60,658
Blood slides (packs)	16,250	0.26	4,306
QBC kits	5	87,340.00	436,700
SUBTOTAL: Laboratory			501,664
NMCP workshop			71,117
NMCP meeting			316
Subsistence			10,000
Mileage			100,000
SUBTOTAL: Workshops and meetings			181,433
Field visits (mileage)			36,000
GRAND TOTAL			4,198,723

Antimalarial drugs: provinces make their own estimates to the Central Medical Stores. Provincial Pharmacists supply District Hospitals regularly on request. The budget is controlled by Provincial Medical Director (PMD).

Transport, fuel, protective gear, camping equipment, casual salaries: all this has been decentralized and the PMD controls the budget.

Manpower: at central level: Chief Field Officer (1), Senior Field Officers (4); at provincial level: Field officers (17): their salaries do not come from NMCP vote allocation.

[1] 1 Z$ rate of exchange varied from 0.20 US$ in June 1992 to 0.16 US$ in June 1993.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