DECREASE OF MALARIA MORBIDITY WITH COMMUNITY PARTICIPATION IN CENTRAL JAVA

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Abstract. Malaria is still a problem in Java-Bali, although the Malaria Eradication Program started in the 1950's. In the First National Five Year Development Plan it was changed to the Malaria Control Program with the aim to reduce the morbidity and mortality rates through surveillance and spraying interventions using the primary health care approach. In 1984 in Central Java there were malaria areas with an average annual parasite incidence (API) between 1 and 7.5 promille covering about six million population, nearly one third of the population of Central Java.

In this study an intervention alternative was carried out with weekly chloroquine prophylaxis to children below 10 years of age in 3 malaria areas of central Java, namely the villages Bedono Kluwung and Kalikutes in Purworejo Regency and Pablengan in Karang Anyar Regency. Health education about malaria with a learning module was conducted by key persons as an element of community participation. The activities of the key persons increassed the ongoing surveillance. After one and a half years intervention (July 1985-February 1987) the spleen rates, parasite rates and fever cases dropped to nearly zero in the three study villages.

From the results of this study it was recommended that in a malaria risk area with an API of more than 1 promille, intervention with collective chloroquine protection to children below 10 years of age could reduce the API to 1 promille or less. This intervention should be carried out if there is an increase of cases in the area to prevent small outbreaks. The time of chloroquine intake should be limited; it should be discontinued when fever cases have dropped significantly. Thereafter it should be followed up by insecticide spraying. This recommendation does not exclude the outlines of the program that surveillance with early diagnosis followed up with rational radical treatment is the best weapon to control malaria through the primary health care approach.

INTRODUCTION

Malaria is still one of the major health problems in Central Java, Indonesia. Reports of the Provincial Health Services of Central Java showed that in the period of the National Third Five Year Plan (1979-1983) an average of 81.4‰ of malaria cases in Java and Bali were from Central Java (Notohamidjoja and Sukamoto, 1984). The annual parasite incidence (API) in the year 1983/1984 in Central Java averaged 4.08‰ (0-26.62‰), the highest being observed in 8 districts with a population of 6,014,980, covering 26.6% of the whole population of Central Java. In 1984 the API showed a slight decrease (2.84‰) but an increase was reported from several districts. From the above mentioned data it could be concluded that malaria in Central Java in 1983/1984 appeared to be unstable and vulnerable to change. The fluctuation of malaria incidence could be prominent, from a hypoendemic situation to a small outbreak or even an epidemic which was not favorable. Indeed, an outbreak in Cilacap District (Fig 1) was reported, reaching a peak by July-August 1984 and followed by another peak in October-November of the same year, causing a high mortality in infants, under fives and aging people, apparently due to *Plasmodium falciparum* infection. Problems of malaria control were described in detail in a report of the Malaria Health Service of Central Java, the important factors being sociological, medical, technical, operational, administrative and environmental.

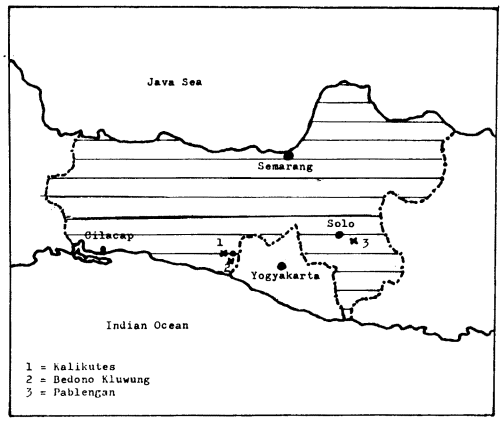

Fig 1 Map of Central Java, Indonesia.

In the Third Five Year Plan, 11 laboratory and field studies were conducted to search for an effective control method suitable to the condition of the population and the environment. Various alternatives to control malaria were tried in the field at small scales, *eg* vector control using insecticides with a more efficient and inexpensive method (Sukamoto, 1985), spraying of cattle stables, maintaining larvivorous fish in the rice fields (Nalim, 1985) and periodical drying of rice fields. However, these alternatives were on a very restricted scale.

After studying the aforementioned situation of malaria, in 1985 this question arose: "Is there a new alternative method which could contribute to the Fourth and the following Five Year Plans to control malaria in Central Java?" Prevention and control of malaria should be more successful if community participation could be activated, *eg* using environmental sanitation and other preventive measures (bednets, drug prophylaxis). In a malaria endemic area, besides the conventional periodic spraying with insecticides, community participation should be activated with health education about malaria to the community.

The objective of the operational field study was to suppress malaria morbidity with three methods of intervention, namely:

1. Treatment of malaria fever cases with presumptive and radical treatment carried out in accordance with the malaria control protocol of the Directorate General of Prevention and Environmental Health Care of Indonesia.

2. Weekly chemoprophylaxis with chloroquine 5 mg/kg body weight for children under 10 years of age, who belonged to the high risk groups and therefore needed protection.

3. Health education with a simple learning module about malaria.

Intervention was carried out by people who were selected from the community for their high motivation and chosen from the existing community organizations. The selected people, called key persons, were trained at the start of the study. Intervention was monitored regularly by the local health center physician in charge of the village area during the study. The expected results could be as follows:

a. A decrease in malaria mortality and morbidity with emphasis on prevention of high incidence outbreaks.

b. An increase in active participation of the community to control malaria and thus contributing to the malaria control efforts of the Government in the primary health care system.

MATERIALS AND METHODS

Selection of study site

Three villages were selected, namely Kalikutes and Bendono Kluwung in the District of Purworejo, and Pablengan in the District of Karang Anyar, Central Java (Fig 1). These villages were selected according to the following criteria:

a. A population of approximately 1,000 people, 25% of whom were children under 10 years of age.

b. An API of above 1‰.

c. Presence of DDT resistant vectors.

d. Absence of chloroquine resistant *P. falciparum.*

e. No malaria intervention activities in 1984.

f. No population movement among the villagers.

Methods

The study was carried out during a period of 19 months. Field surveys were conducted in July 1985 for pre-intervention studies, in April 1986 (9 months intervention), in July 1986 (12 months intervention) and in February 1987 (19 months intervention). Census of the villagers was carried out and anthropological data obtained. Clinical and malariometric data were collected for spleen rates, parasite rates and hemoglobin (Hb) levels. Sociological data were also collected for KAP (Knowledge, Attitude and Practice) studies with questionnaires, observations and discussions in the pre- and post-test periods to measure the use of the learning module about malaria as a tool for health education. Ten key persons from each village were selected and trained to distribute the chemoprophylactic drug chloroquine weekly at a dosage of 5 mg/kg bw to children under 10 years of age, and each key person visited 20 households once weekly which were under their responsibility. With these visits they were able to detect fever cases and take blood for parasite examination, while presumptive treatment with a single dose of chloroquine was given. If the blood was positive, the patient was given radical treatment. Key persons were also expected to give health education about malaria to the community/households under their care and assist the health center physician responsible of the intervention activities.

RESULTS

A total of 3,220 villagers from 322 households living in Kalikutes, Bedono Kluwung and Pablengan were examined (Table 1).

The results shown in Tables 2, 3 and 4 revealed that:

1. From pre-intervention studies, the three villages Kalikutes, Bedono Kluwung and Pablengan turned out to be hypoendemic areas as seen from the respective spleen rates of 3.7%, 5.3% and 3.8% (Table 2), parasite rates of 1.1%, 2.2% and 4.8% and infant parasite rates of 0%, 0% and 16.7% (Table 3).

2. Post-intervention studies (19 months intervention) showed spleen rates, parasite rates and infant parasite rates of 0 in all three villages.

3. Fever cases also decreased in Kalikutes and Pablengan due to the activities of their key persons to detect fever cases during the weekly visits (Table 4). No fever reports were received from Bedono Kluwung. In Kalikutes, monthly reports of active case detection (ACD) during the period of 2 years showed malaria positive cases were still present until May 1987 with the highest percentage in August 1985 (25.0%). In Peblengan, at the start of ACD activities in July 1985, 8 positive slides were detected out of 64 fever cases found. In the following months until April 1987,

Table 1

Number of population and study samples in Kalikutes, Bedono Kluwung and Pablengan, Central Java.

No.	Kalikutes	Bedono Kluwung	Pablengan	Total
Population of village (according to census of subdistrict)	912	1243	1513	3667
Sample of households	217	246	285	748
Blood samples collected	863	1006	1351	3220
Spleen examination	863	1006	1351	3220
Household interview	106	103	113	322
Children under 10 years of age given chemoprophylaxis	238	307	409	954

Table 2

Prevaience of splenomegaly cases and spleen rates at pre- and post-intervention in Kalikutes, Bedono Kluwung and Pablengan, Central Java.

Village	July 1985 pre-intervention		April 1986 9 months inter-vention		July 1986 12 months inter-vention		February 1987 19 months inter-vention	
	1	2	1	2	1	2	1	2
Kalikutes	2.3% (20/863)	3.7% (7/190)	0.4% (3/834)	0% (0/177)	0.4% (3/804)	0% (0/167)	0% (0/773)	0% (0/163)
Bedono Kluwung	4.1% (41/1006)	5.3% (12/228)	NE	NE	2.5% (20/793)	4.1% (8/193)	0% (0/724)	0% (0/243)
Pablengan	1.9% (25/1351)	3.8% (12/313)	0.7% (9/1299)	1.3% (4/311)	0.3% (4/1289)	1.3% (4/304)	0.1% (1/1314)	0% (0/312)

NE = not examined
1 = prevalence of splenomegaly
2 = spleen rate (2-9 years)

Table 3

Parasite prevalence and parasite rates at pre-and post-intervention in Kalikutes, Bedono Kluwung and Pablengan, Central Java.

Village	July 1985 pre-intervention			April 1986 9 months intervention			July 1986 12 months intervention			February 1987 19 months intervention		
	1	2	3	1	2	3	1	2	3	1	2	3
Kalikutes	3.6% (31/863)	1.1% (2/190)	0% (0/11)	9.1% (75/834)	6.3% (11/174)	9.1% (1/11)	5.1% (41/804)	6.0% (10/167)	7.7% (1/13)	0% (0/773)	0% (0/163)	0% (0/8)
Bedono Kluwung	2.0% (20/1006)	2.2% (5/228)	0% (0/10)	NE	NE	NE	0.1% (1/775)	0.1% (1/191)	0% (0/20)	0% (0/724)	0% (0/185)	0% (0/4)
Pablengan	3.1% (42/1351)	4.8% (15/313)	16.7% (1/6)	0.4% (5/299)	1.0% (3/311)	0% (0/24)	0.2% (2/1289)	0% (0/304)	0% (0/17)	0.1% (1/1314)	0% (0/312)	0% (0/31)

NE = not examined
1 = parasite prevalence
2 = parasite rate (2-9 years)
3 = infant parasite rate (< 1 year)

Table 4

Active case detection by key persons in Kalikutes and Pablengan, Central Java during the period of July 1985 - June 1987 as reported by their health center physician in charge.

Month	July 1985 - June 1986						July 1986 - June 1987					
	Kalikutes			Pablengan			Kalikutes			Pablengan		
	a (%)	b	c	a (%)	b	c	a (%)	b	c	a (%)	b	c
July	0 (0/2)	0	0	12.50 (8/64)	2	6	7.69 (2/20)	2	0	0 (0/15)	0	0
August	25.00 (2/8)	2	0	4.35 (3/69)	2	1	0 (0/3)	0	0	0 (0/4)	0	0
September	0 (0/3)	0	0	5.88 (1/17)	0	1	0 (0/24)	0	0	0 (0/32)	0	0
October	0 (0/20)	0	0	12.24 (6/49)	2	4	0 (0/16)	0	0	0 (0/6)	0	0
November	0 (0/12)	0	0	16.07 (9/56)	0	9	0 (0/13)	0	0	0 (0/34)	0	0
December	13.6 (3/22)	3	0	4.00 (1/25)	0	1	0 (0/16)	0	0	0 (0/37)	0	0
January	0 (0/14)	0	0	0 (0/35)	0	0	0 (0/15)	0	0	0 (0/1)	0	0
February	0 (0/20)	0	0	0 (0/18)	0	0	5.56 (1/18)	1	0	0 (0/11)	0	0
March	0 (0/12)	0	0	0 (0/17)	0	0	0 (0/18)	0	0	0 (0/17)	0	0
April	4.76 (1/21)	1	0	12.50 (1/8)	0	1	0 (0/19)	0	0	0 (0/9)	0	0
May	8.33 (1/12)	1	0	8.33 (1/12)	0	1	9.09 (1/11)	1	0	-/0 ++	0	0
June	0 (0/12)	0	0	0 (1/12)	0	0	0 (0/12)	0	0	-/0 ++	0	0
Total	4.38 (7/158)	7	0	8.12 (31/382)	6	24	2.16 (4/185)	4	0	0 (0/166)	0	0

++ = no fever cases detected
a = percentage of positive malaria slides from fever cases
b = *Plasmodium falciparum*
c = *Plasmodium vivax*

between 1 and 69 fever cases were discovered monthly with malaria positive slides between 0 and 9, the highest percentage being in November 1985 (16.07%). Since June 1986 no positive slides were recorded and in May and June 1987 no fever cases were reported. In Kalikutes, although the spleen rate (2-9 years) was down to 0 since April 1986 (after 9 months intervention), the parasite rate showed an increase and did not decrease until February 1987 (after 19 months intervention) and fever cases were still observed by the key persons. In Bedono Kluwung splenomegaly was still encountered in children of the 2-9 years age group after 12 months intervention (July 1986) while parasitemia was not present any more. This was also the case in Pablengan : after 12 months intervention splenomegaly was still present in the 2-9 years age group although no parasitemia and no fever cases were encountered.

4. Hemoglobin levels of the villagers in three study areas showed a slight anemia, 10.1-12.6 in the male group and 10.0-11.8 in the female group, and remained so until the end of the study. No significant difference was observed.

Sociological studies

In general the socioeconomic condition of the population in the three villages could be described as follows.

The majority of the population were farmers with an income between low and medium level. Knowledge about malaria at the start of intervention was generally sufficient; at least they had heard about malaria, although they were not well informed. Post-intervention studies showed an increase in knowledge of the disease and a positive change in attitude, especially in the regular intake

of the chemoprophylactic drug. About 95% of the children under 10 years of age took the drug regularly; only about 5% drop outs were recorded.

After the key persons made regular weekly visits to distribute the drug and gave health education with the learning module, 19 months later a change in attitude about malaria was observed in the community. Before intervention their concept about the disease was that malaria was not a dangerous disease and could not be fatal. But after the intervention they could say that if malaria was not well treated it might result in a chronic and costly disease and could be fatal. Before intervention they used bitter-tasting traditional drugs for treatment as well as for prophylaxis. After intervention they asked for antimalarial tablets, although still not abandoning their habit of taking traditional medicine.

A change in the behavior of treatment was also observed. Before intervention they practiced self-treatment, but after intervention the community started to make use of the health center in the village for treatment.

DISCUSSION

The 19-month study in three villages of Central Java showed significant results as seen in the dramatic decrease of spleen rates and parasite rates after administration of weekly chemoprophylaxis to children under 10 years of age. This protection was conducted simultaneously with health education to the highly motivated community by means of the learning module and carried out by the key persons who visited the households regularly. Fever cases detected by key persons during ACD activities dropped conspicuously. The key to this success appeared to be the appropriate selection of key persons, experienced in motivating the community, the discipline of the parents and children leading to the regular intake of the drug (only 0.8% failure), the spread of knowledge about malaria by the community through conversation and use of the learning module.

Chemoprophylaxis in children under 10 years of age significantly decreased the prevalence of malaria from 3.1% to 0. In Pablengan, the prevalence of less than 1% was reached after 9 months intervention (Tables 2, 3). For Bedono Kluwung no surveys were carried out at that time, but the prevalence of less than 1% was reached after 12 months intervention. However, Kalikutes reached the prevalence of less than 1% only after 19 months intervention (an increase was recorded at 9 and 12 months intervention and the cause of this increase could not be explained).

Experience of morbidity decrease with chloroquine prophylaxis and health education was obtained from an earlier field study in Berakit village, Riau Province (Pribadi *et al,* 1985, 1986, 1989), which was hyperendemic and control measures were never carried out. Intervention with weekly chloroquine prophylaxis to 580 people during one year resulted in a dramatic decrease of spleen rates from 67.5% to 31.0% and a decrease of parasite rates from 13.6% to 4.7%. The results of the study in Berakit could be considered as a starting point to define a new alternative and to try it in three villages of Central Java as a pilot project. Indeed, observation of fever cases showed that morbidity of malaria in this study area was also decreased.

The use of antimalarial drugs as mass chemoprophylaxis drew many controversial questions. In the absence of resistant parasite strains chloroquine as a safe and potent schizontocide is still the drug of choice in the malaria control program in the prevention of mortality and decrease of morbidity in the field. Mass chemoprophylaxis with chloroquine would select sensitive *P. falciparum* strains while the resistant ones remained to establish a chloroquine resistant *P. falciparum* focus in that area. However, the duration of this process is still unknown. In Malaysia (Dondero *et al,* 1975) reports from an endemic malaria area revealed a triple increase of resistant cases after 22 months of chloroquine pressure. Many other factors appeared to be involved concerning the development of *P. falciparum* resistance to chloroquine.

However, toxic side effects of long term chemoprophylaxis in the field were mild. Only a few cases of pruritus and blurring of vision were reported. Moreover, development of immunity was not affected by the chemoprophylaxis (Bruce-Chwatt, 1980).

Could collective chemoprophylaxis as community health intervention be of benefit as an effort of health service with PHC approach? Of

course, immediate benefit could be experienced by the people of an endemic area as was recorded in Africa where morbidity decreased, and in some community groups hemoglobin levels increased, together with slight body weight increase. This question should be considered specifically for the situation of malaria in Central Java, with its occasional small outbreaks to be controlled immediately, and with chloroquine resistant *P. falciparum* foci in four areas (Jepara, Batang, Pekalongan and Wonosobo).

Arguably the right place to carry out chemoprophylaxis is an unstable hypoendemic malaria risk area with an API above 1‰. Strict surveillance should then be carried out to detect immediately a slow or rapid increase of malaria cases, such as in areas where environmental changes occur due to development projects. From the 1984 data, there are 8 districts in Central Java convering a population of 6,014,980 with an API between 1 and 7.5‰.

Chemoprophylaxis should be aimed at the high risk groups, namely children under 10 years of age and pregnant women; total coverage of the pupulation in this hypoendemic area is not necessary. The time needed for prophylaxis depends on the tendency of increase or decrease in malaria cases. A time limit of 6-9 months is sufficient to carry out an evaluation of API surveys. In the case of an outbreak, chloroquine chemoprophylaxis should be given to the whole population until one month after cessation of the outbreak. One should of course be aware and monitor the possibility of *P. falciparum* becoming resistant to chloroquine.

It should be emphasized that chemoprophylaxis is designed for a short term program with the aim to reduce malaria morbidity immediately and should be followed up by maintaining a good surveillance through participation of key persons and other members of the community, eg mothers who are already aware of the malaria problem. Chemoprophylaxis should also be carried out in endemic areas where it is impossible to apply the conventional WHO control program (insecticide spraying and surveillance) which is also too expensive. Failure of chemoprophylaxis with chloroquine in pregnant women in Kenya (Kaseje *et al,* 1987) and in children in Tanzania (MacCormack and Lwihula, 1983) have been reported because of many constraints, eg lack of awareness of the pregnant women of the existence of village health helpers to supply the drug, fear of chloroquine induced itching and other side effects (such as vomiting), the assumption that the drug was better for treating malaria than for preventing it, irregular supplies at local level because of poor communication, vehicle breakdowns, bad roads, key persons being away or too busy, and exclusion of socially marginal children. However, good results were obtained in Namibian refugee children in Angola (Saarinen *et al,* 1988) who received daily chemoprophylaxis with proguanil following presumptive treatment with chloroquine. In Malawi, 96% of British residents used malaria chemoprophylaxis (Harries *et al,* 1988). They obrained their advice from British sources and 75% considered they were adequately informed on the subject. However, 27% of adult residents discontinued prophylaxis prematurely on return to the United Kingdom.

Collective chemoprophylaxis should be considered when there are signs of small malaria outbreaks. The time of chloroquine intake to children under 10 years of age should be limited, discontinued immediately when fever cases drop significantly. Afterwards insecticide spraying should be carried out for maintenance.

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