

MALARIA IN YUANYANG, YUNNAN, PEOPLE'S REPUBLIC OF CHINA – NEW CONTROL STRATEGY (1992 -1996)

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INTRODUCTION

Yuanyang County has long been considered high malaria endemic area in Yunnan, China (Ling *et al*, 1936). Considerable control had been achieved over the disease by the middle of 1980s in the county. However, a resurgence of the disease has been noted since late 1980s, particularly of *Plasmodium falciparum* (Zhu, 1994). Only 9 falciparum malaria cases were reported in the county in 1987; 860 falciparum malaria clinical cases were reported in 1991 (Table 1), of whom six patients died of the infection of *P. falciparum*. Consequently, a large-scale malaria control program has been carried out since 1992.

Control area and population

Yuanyang is situated in the middle and lower reaches of the Red River, approximately 150 km north of Vietnam. The county has a combined area of 2,200 km². Topographically, it is a basically mountainous area with vertical landscape and climate, the highest altitude is 2,939 m and the lowest 207 m in the county. The county has a tropical monsoon climate with the mean temperature of 16.4°C, and its annual mean precipitation of 1,421.4 mm. There are two seasons: the rainy season is from May to October, the dry season from November to April. The vertical variation of climate is obvious, with mean temperatures around 11.6°-12.8°C above the altitude of 1,800 m, 15°-17°C below 800 m. Malaria transmission is perennial, peaking in the rainy season from May to November where *P. falciparum* and *P. vivax* co-exist. The principal vectors of malaria is *An. minimus*. The transmission of malaria is mainly in the areas under the elevation of 1,200 m above sea level (Zhang, 1990; Zhu *et al*, 1994). The total population is around 340,000, most of whom are belong to Hani and Yi ethnic groups, and around 10% of the population immigrate from outside counties in which they plant banana and other fruit trees.

Control strategy and implementation

In 1992 a systematic well-planned malaria

control strategy was initiated. All natural villages in the county were stratified into three strata based on the information of the incidence of malaria in the previous year and the topographical features of each individual village. Different malaria control strategies were based on new stratification. The stratification had been updated annually based on the latest malaria incidence information. Stratum one: villages in which malaria incidence rate was over 2% in the last year and are located in the area under the altitude of 1,500 m. All households in stratum one should be sprayed with DDT at the dosage of 2 mg/m². If the malaria incidence rate of a village was over 4% in the stratum, chemoprophylaxis should be carried out for all inhabitants with chloroquine 1.2 g for 3 days and primaquine 180 mg for 8 days in the peak transmission season in the village apart from DDT residual spraying at the main transmission season. In stratum two, villages with malaria incidence was lower than 2% or over 2% but in areas where the altitude is over 1,500 m, chemoprophylaxis was taken by persons in the same household with patients and their immediate neighborhoods, with chloroquine 1.2 g for 3 days and primaquine 180 mg for 8 days. In stratum three, villages with no malaria case was reported, strategy mainly focused on routine surveillance. Beside, all confirmed malaria cases were treated with chloroquine 1.2 g for 3 days and primaquine 180 mg for 8 days and the same dosages were administered to the patients for anti-relapse treatment in the county. Presumptive treatment was given to all suspected malaria cases with chloroquine 1.2 g for 3 days and primaquine 120 mg for 4 days.

Malaria surveillance

Extensive surveillance has been conducted in the county by blood examination since 1987. Blood examination stations were set up in all administrative townships. All village doctors and the doctors in the township hospitals were asked to prepare thick and thin blood slides from all febrile patients and send them to the stations for microscopical examination. Repeated cross-sectional surveys were

also done, the population sampled randomly by village group according to malaria incidence, geographical and topographical characteristics. Mass blood examination for detection of malaria parasitemia was conducted on the study population and primary school students during the malaria transmission season. All blood slides were stained with Giemsa's stain; thin films were used to confirm species identification.

RESULTS

In 1992, 1993, 1994, 1995, 1996, populations of 135,940, 106,273, 76,663, 118,703 and 61,826,

respectively, lived in the areas subjected to DDT residual indoor spraying. A total of 97,261 households were sprayed with the insecticides. From 1992 to 1996, 7,766 persons received treatment for acute malaria with chloroquine and primaquine for 8 days, 594,890 received chemoprophylaxis with chloroquine and primaquine at peak transmission seasons, 29,084 received presumptive treatment, and 52,064 persons were treated outside of main transmission season with the aims of preventing relapse.

As a result of these new integrated control measures, the number of malaria cases had been decreased progressively, particularly for falciparum malaria (Table 1). The results of the annual cross-

Table 1
The results of routine malaria surveillance in Yuanyang, Yunnan, China (1987-1996).

Year	No. slides examined	No. positive		Incidence per thousand population	
		<i>P. vivax</i>	<i>P. falciparum</i>	<i>P. vivax</i>	<i>P. falciparum</i>
1987	30,694	1,602	9	5.1	0.03
1988	38,674	1,768	19	5.5	0.06
1989	33,100	1,755	10	5.4	0.03
1990	33,243	1,424	32	4.4	0.09
1991	36,547	1,332	860	4.0	2.6
1992	32,406	1,911	193	5.8	0.6
1993	31,474	1,312	256	3.9	0.8
1994	33,794	1,152	339	3.4	1.0
1995	31,081	817	139	2.4	0.4
1996	30,162	634	89	1.9	0.3

Table 2
Cross-sectional malaria surveillance in Yuanyang, Yunnan, China (1987-1996).

Year	No. population sampled	No. parasitemic		Prevalence per thousand population	
		<i>P. vivax</i>	<i>P. falciparum</i>	<i>P. vivax</i>	<i>P. falciparum</i>
1987	1,618	22	0	13.6	0
1988	1,307	39	0	29.8	0
1989	1,390	14	1	10.1	0.7
1990	3,712	58	51	15.6	13.7
1991	4,843	82	116	16.9	23.5
1992	5,616	83	79	14.8	14.1
1993	19,303	184	79	9.5	4.1
1994	10,890	133	14	12.2	1.3
1995	4,398	49	9	11.1	2.1
1996	2,157	5	0	2.3	0

sectional surveys on residents and elementary school students are consistent with those of routine surveillance (Table 2).

DISCUSSION

The recent re-assessment of malaria control strategy has led to focus on requirement of local conditions (WHO, 1993). The key element in a control program is the recognition of variability of environmental and epidemiological parameters, which influence the pattern of malaria transmission risk. From 1992 to 1996, the new integrated malaria control strategy, based on the knowledge of the endemicity of malaria and topographical feature of a village, had apparently decreased malaria incidence and prevalence in Yuanyang county, Yunnan Province. The timely updated and re-stratification

of malaria situation based on environmental parameters is crucial for the present successful control program.

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