BORDER MALARIA IN YUNNAN, CHINA

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Abstract. Yunnan Province, due its international borders with Myanmar, Vietnam and Lao PDR has a large number of imported cases of malaria, including a high proportion of *Plasmodium falciparum*, as a result of the mobility of the population. This movement is due to workers coming from other provinces where there is no malaria to work in the productive tropical lowlands, Chinese nationals who have gone to work in neighboring countries, border trade and refugees from Myanmar.

Much of Yunnan is peopled by ethnic minorities living in remote mountainous and forested areas which are difficult to reach. However, surveillance has been strengthened by training 3,900 primary health care workers and combining the search for visiting foreigners, returning Chinese and people from other provinces with public security, customs formalities and employers. Any visitor detected by these services is obliged to have a blood slide taken. This has resulted in an earlier and more complete detection of malaria cases, reducing incidence from 19.19 to 12.12/10,000 in the border area over the last 10 years. This is despite a considerable increase in population movement and the threat of drug resistant malaria.

INTRODUCTION

Yunnan Province is situated in the southwest of China and has 4,061 km of border with three other countries, Vietnam, Lao PDR and Myanmar. The border area includes 26 counties or municipalities in 8 prefectures. The population of Yunnan is 38,034,434 of whom 5,736,828 (15%) live in these border areas. Many of these people are ethnic minorities with differing life styles and standards of living.

Although the mean annual parasite incidence (API) is only 3.99 per 10,000, this can vary considerably from area to area. A major problem is the high level of multi-drug resistant *Plasmodium falciparum* making malaria control difficult (Yang *et al*, 1995). Tremendous progress has been made in controlling malaria in China (Advisory Committee on Malaria 1994; Xu *et al*, 1994) but if the problem in Yunnan cannot be contained, the spread of resistant *P. falciparum* in the country could reverse this success.

THE MALARIA PROBLEM AREAS

Ethnic minorities

There are 13 minority nationalities in the border area, which is largely mountainous, making access difficult. Much of the area is forested and villages are difficult to reach. These people live in simple thatched houses, often with poor quality walls making residual spraying difficult, while mosquito nets are not commonly used. This situation was identified by Kondrashin *et al* (1991) as a common scenario in much of Southeast Asia. Detailed malariometric surveys have not been made in the whole area, but spot surveys found a parasite rate of 30.5% (12.4% prevalence of *P. falciparum*) in a Hani village, 12.5% (2.5% *P. falciparum*) in a village of the Dai minority and 14.3% (4.8% *P. falciparum*) in a Wa village.

Migrant farm workers

With a tropical climate in the southern part of the province, rubber, coffee, tea, sugar cane and various tropical fruits are grown in plantations, attracting migrant laborers. These come from non-malarious areas, so have no immunity and suffer a high degree of morbidity and some mortality. These plantations are often small enterprises situated some distance from government health facilities. In Jiabutuo rubber plantation with 507 workers the parasite rate was 60.1%, *P. falciparum* rate 43.1% and mortality 9.9% in 1990. In a sugar cane plantation 31.5% were found to be positive (25.7% *P. falciparum*) and with a mortality of 9.26%. In a

spice growing area 46.7% were found positive (32.8% *P. falciparum*), but there were no deaths.

Workers returning from other countries

With the "Open Door" policy many people now cross the border into neighboring Myanmar, Lao PDR or Vietnam to work in mining, road construction or the lumber industry (Tin and Tun, 1991). Usually working in forested and/or mountainous areas, with little malaria control activities, they often return to their homes in China infected with malaria. The average parasite rate in fever cases returning from foreign countries was 6.7% (580/8,694) in 1995 with 1.8% *P. falciparum*. In 1991 some 40,000 lumber workers returned to Yunnan 22.7% of which had malaria and in 1992 nearly one thousand farm workers returned from Myanmar with a 34.02% parasite rate and 26.6% *P. falciparum*. Two died.

Border trade

The expanding market economy has encouraged border trade across the 5 national, 12 provincial and 226 unofficial border crossing places in Yunnan. It is estimated that some 10 million people are moving around in the border area, many of whom are non-immunes. The majority of these are Chinese people going out or returning home, while a large number of foreigners cross the border to get treatment in China. These are shown by category for 1995 in Table 1. Malaria incidence was found by Zhu *et al* (1992) to be directly proportional to length of stay among people going to Myanmar. The most serious problem is the importation of *P. falciparum* cases, many of which are drug resistant (Yang *et al*, 1995) and if not detected in the border area can result in the introduction of drug resistant *P. falciparum* into inland areas of Yunnan or other provinces in China.

Refugees from Myanmar

Insurgency and conflict within Myanmar has led to an influx of refugees, often bringing malaria with them. In 1987, 7,838 refugees entered 45 villages in Yunnan leading to malaria outbreaks, increasing the incidence from 0.52/1,000 in 1985 to 4.57/1,000 in 1989. In 1992 a further 11,000 refugees crossed into the same area of Yunnan but due to improved surveillance (see below) no secondary cases resulted.

CONTROL MEASURES

The main emphasis of control has been on the strengthening of surveillance, improving case finding and treatment. This is especially important in remote mountain areas, amongst the ethnic minorities which are difficult to reach. The training of primary health care (PHC) workers has provided advanced warning of imported cases and allowed rapid treatment. In one village in 1992 32.5% were found to have malaria, but by 1994 only four cases of malaria were detected, due to the action of two PHC workers.

Following a directive worked out by the Ministries of Health, Public Security, City Countryside

Table 1

Type of person contracting malaria in the Yunnan border area in 1995.

Persons	Total	Positive	%	*P. falciparum*
Foreigners coming to China for treatment	4,593	515	11.21	4.99%
Foreigners entering Yunnan	1,835	46	2.51	0.98%
Chinese from non-border areas seeking treatment	18,129	1,926	10.62	3.40%
Chinese coming to border areas from inland* areas	3,710	64	1.72	0.32%

* Inland areas include non-border areas of Yunnan and other provinces.

Table 2

Number of villages with outbreaks and proportion positive in 1989 and 1993.

Year	No. outbreak villages	Total population	No. examined	No. positive	No. Pf	% positive	% Pf
1989	39	4,008	883	379	126	42.92	14.27
1993	10	4,993	1,834	468	100	25.52	5.45

Construction and Environmental Protection, Water Conservancy and Electric Power, Agriculture, Grazing and Fisheries (Endemic Diseases Control Bureau, 1988) all 26 counties have been strengthened in order to detect mobile populations. The public health departments are assisted by the public security, customs, industrial and commercial bureaux, border police and farm management to find any people from other countries, indigenous workers returned from another country, coming from another province or from a low-land malarious area. All such persons are obliged to report to the PHC worker to have a blood slide taken. Health education is also given to workers planning to work in another country or malarious area.

The development of the surveillance mechanism has resulted in the formation of 34 surveillance centers, 390 blood examination centers and more than 3,900 PHC workers. This extensive surveillance mechanism has been able to detect case in remote areas and provide effective treatment to prevent outbreaks occurring. This is seen in the reduction in number of villages with outbreaks and the proportion in the whole border area, as shown in Table 2.

DISCUSSION

The annual malaria incidence has declined from 5.67/10,000 in 1985 to 3.99/10,000 in 1995 in the whole province and from 19.19/10,000 to 12.12/10,000 in the border area. These achievements, together with a reduction in the number of outbreak villages were attributed to the implementation of the multi-disciplinary surveillance and control program. This took four years to be formulated so did not come into effect until 1990. Unfortunately the development of the market economy now threatens this success as there is less money from the government and PHC workers are tempted into private practice.

It is estimated from the departments of public security, customs and frontier inspection that there are more than 10 million mobile people in the Yunnan border area. There are 4 million entries by foreigners and 2.5 million re-entries by Chinese national each year. This makes malaria control in the Yunnan border areas an international problem and regional collaboration between Myanmar, Lao PDR, Vietnam and China is required (Karbwang and Harinasuta, 1993).

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