

CONTROL STRATEGIES OF MALARIA IN HENAN PROVINCE, CHINA

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Abstract. Malaria had been one of the main problems of public health, with the highest incidence rate of 16.94%, in Henan Province of China in 1970. The rate has been very low (about 5 per 100,000) in the 1980s and the 1990s since malaria had been controlled in the 1970s. But in recent years, malaria has resurged and outbreaks occurred with an incidence rate of more than 40% in some local areas where *An. anthropophagus* was the main vector, and falciparum malaria cases have been found. At present, malaria control strategies should focus on surveillance of malaria, management of population dynamics, health education and adopting practicable integrated measures.

INTRODUCTION

Henan province is located between 31° 23' to 36° 21' N and 110° 21' to 116° 39' E in the central part of China. The area is nearly 167, 000 km² with a population of about 92 million. Malaria had been one of the main problems of public health in Henan Province. There had been three outbreaks during the period from the 1950s to the 1970s. The latest major epidemic occurred in 1970 with 11 million malaria cases reported, and the incidence rate was as high as 16.94% in the province. During the past two decades, malaria control campaigns have been carried out in the whole province through the primary health care system, with community participation. Malaria control programs were implemented according to time- and locality-oriented approaches (Tang *et al*, 1991). Measures were mainly concentrated on control of the infectious source in the areas where *Anopheles sinensis* was the main vector and concentrated on the infectious source as well as vector control in the areas where *An. anthropophagus* was the main vector. As a result, remarkable success was achieved. Falciparum malaria has not been reported since 1988. In 1994, only 721 vivax malaria cases were reported and the incidence rate was less than 0.82/100, 000 in the province (Li *et al*, 1995). But in recent years, malaria has resurged and even more outbreaks occurred in some local areas where *An. anthropophagus* was the main vector (Sleigh *et al*, 1998).

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Epidemiological features

Success has been maintained in the areas where *An. sinensis* was the main vector. In 1997, 3,944

malaria cases were reported in 17 cities and/or prefectures of the whole province. The malaria incidence rate was 4.29/100,000. Only 301 cases were reported in 15 cities and/or prefectures where *An. sinensis* was the main vector. They made up 7.63% of the cases reported in the province in 1997. The incidence rate was 0.35/100,000 in these areas. No malaria case was reported in one city and the number of cases reported was less than 10 in 9 cities, respectively. From the epidemiological investigations in four cities in 1997, the average incidence rate was 0.70/100,000, and the positive rate of blood slide examination in febrile patients was 0.84/100,000, which was reduced by 18.28% in comparison with that in 1996. The distribution of malaria cases was highly sporadic.

Malaria cases were mainly concentrated in Tongbai mountainous areas where *An. anthropophagus* was the main vector. 3,643 of 3,944 malaria cases in 1997 were reported in 7 counties with a population of 6.5 million in Nanyang city and Xinyang prefecture in Tongbai mountainous areas where *An. anthropophagus* was the main vector. The incidence rate was 55.85/100,000. They made up 92.37% of the total cases of malaria reported in Henan Province. 3,593 cases reported in two counties (Tanghe and Tongbai) of Nanyang city and in Xinyang county of Xinyang prefecture together made up 91.10% of those in the province in 1997.

Malaria outbreaks (Table 1) occurred in some villages where *An. anthropophagus* was the main vector. *An. anthropophagus* made up 53.66% of mosquitoes captured in bed nets indoors and 40.74% of those captured in nets outdoors in the areas.

Imported falciparum malaria cases were found in the counties where falciparum malaria has been

Table 1
Epidemics of malaria in some villages of Tongbai mountainous areas.

County	Township	Village	Incidence rate of malaria (%)	
			in 1995	in 1996
Xinyang	Shihegang	Datian	45.30 (82/181*)	44.58 (37/83)
		Baimiao	19.47 (37/190)	10.96 (8/73)
Tongbai	Chengjiao	Wuwan	46.70 (85/182)	30.03 (109/363)
		Chengwan	49.33 (86/174)	44.93 (93/207)
	Shi jialou	0 (0/240)	0 (0/200)	

* Number of malaria cases/ population investigated.

Table 2
Results of the surveillance spots.

Year	Cases (morbidity)	Positive rate of <i>P.vivax</i> in febrile patients	Rate with <i>P.vivax</i> in inhabitants
1996	76 (15.23%)	230/413 (53.36%)	20/306 (6.53%)
1997	43 (8.62%)	39/123 (31.71%)	2/300 (0.67%)

eradicated for 9 years. No falciparum malaria case had been reported in the province since 1988. But in 1997, there were 14 falciparum malaria cases reported in the whole province. All of them were imported. One was reported in Lushi county of Sanmenxia city and the others were reported in Taikang county of Kaifeng city. In August 1997, 48 malaria cases were found in surveillance of 168 peasants, who returned from Hainan Province for work, in Taikang county where malaria has been eradicated for 5 years and falciparum malaria has been eradicated for 9 years. 13 of 48 cases were identified by blood slide examination as falciparum cases and all of them were resistant against chloroquine.

Measures and effects

Treatment of clinical patients with malaria: 4,560 clinical patients with malaria were treated in a standard therapy with chloroquine 1.5g for 3 days and primaquine 150mg for 5 days in Henan Province in 1997.

Anti-relapse therapy in the inter-transmission season: 2,771 cases who had malaria in the past year and 24,000 inhabitants at high risk were treated with primaquine and pyrimethamine in the inter-transmission season (from March to May) in Nanyang city and Xinyang prefecture in 1997.

Impregnated bed nets with pyrethroid insecticide: 140,703 bed nets were impregnated with pyrethroid insecticide in 184 villages with a population of

358,500 in 23 townships of 6 counties where *An. anthropophagus* was the main vector in Nanyang city and Xinyang prefecture in May 1997.

The results of epidemiological investigations showed that the under-reported rate was very high. There were 3,944 malaria cases according to the case report system but in fact there were 4,592 malaria cases by investigations in the whole province in 1997. 648 malaria cases were under-reported, a rate of 14.11% from the point of view of the whole province but the rate was as high as 74.05% in one county where *An. anthropophagus* was the main vector and had malaria outbreaks occurred in recent years.

The surveillance results showed that the effect of the control measures was obvious. Surveillance of malaria was carried out in Datian village with a population of 499 in Shihegang township of Xinyang county in 1996 and 1997. The surveillance results showed that the effect of the control measures was obvious (Table 2). Morbidity, positive rate of *Plasmodium vivax* in febrile patients by blood slide examination and the rate with *P.vivax* in the inhabitants in 1997 were greatly decreased in comparison with those in 1996. They were dropped by 43.40%, 40.57% and 89.74%, respectively.

STRATEGIES

Henan province is an unstable endemic region of malaria. It can be divided into two kinds of areas

by the main transmission vector, which is *An. anthropophagus* or *An. sinensis*. One kind of area belongs to stable zone where the control success has still been maintained and the main vector was *An. sinensis*. The other belongs to a relatively unstable zone where malaria had never been controlled, the main vector is *An. anthropophagus*, and where malaria resurged and outbreaks occurred with a high incidence rate in recent years. In view of the present situation of malaria, strategies of control should focus on surveillance of malaria, management of dynamic populations, health education and research, and adopting practicable and integrated control measures in accordance with the types of endemic areas. It is the goal to consolidate the control achievements in the areas where *An. sinensis* the main vector, actively control prevalence and outbreaks, and further lessen malaria hazards in the areas where *An. anthropophagus* is the main vector, and finally to eradicate malaria in the whole province.

Strengthening surveillance of malaria

Malaria surveillance should be taken as the predominant measure in the areas where *An. sinensis* is the main vector and the eradication campaigns in the 1970s and the 1980s were successful and the success has been maintained. All of the febrile patients and more than 2% of the inhabitants in the areas where *An. anthropophagus* is the main vector should have blood slide examination in accordance with the demand proposed by the National Malaria Advisory Committee.

Adopting practicable and integrated control measures

Practicable and integrated control measures should be adopted in the areas where *An. anthropophagus* is the main vector. Clinical patients with malaria should be treated by the standard therapy. Those persons who had malaria in the past year should be given the anti-relapse therapy in the inter-transmission season. The first priority is to ensure to have all bed nets impregnated with insecticide before the transmission season, two times within two years. The epidemic reporting system should be strengthened so as to reduce the under-reported rate.

Strengthening management of dynamic populations

Management of dynamic populations should be strengthened in the whole province so as to find

malaria cases in time, to treat them as soon as possible and to prevent them from transmission, especially falciparum malaria. All individuals who are going out for work to areas where there is endemic malaria (such as Hainan and Yunnan provinces) should be given drugs (for example: pre-packed antimalarials in tinfoil paper which increases compliance and reduces wastage) and taught some know-how for prevention of malaria. And those returned individuals from the endemic zones should have blood taken for slide examination.

Carrying out scientific research

Scientific research in the field of ecology of *An. anthropophagus*, and simple and feasible drug supply should be taken into account. In 1985, malaria prevalence including falciparum malaria were effectively controlled by spraying DDT on the inside walls of houses. But the effectiveness of impregnated bed nets with pyrethroid insecticide for two years (in 1995 and 1996) was not as good as that in 1985 and the epidemics in some townships were not under control in the areas, where malaria outbreaks occurred in recent years. *An. anthropophagus* still was the predominant species and made up 48.28% and 15.39% of the mosquitos captured, respectively, in 1996 and 1997. Now problems have arisen.

Launching health education

Health education is one of the most important measures for control malaria, which can change the habit of outdoor sleeping of inhabitants in summer and improve awareness and ability for self-protection. In view of the fact that more than 80% inhabitants have little knowledge on malaria prevention, it is more important to carry out the various forms of health education.

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