



Malaria parasite burden and treatment seeking behavior in ethnic communities of Assam, Northeastern India

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Accepted 28 February 2005

Available online 7 April 2005

KEYWORDS

Malaria;
Plasmodium falciparum;
P. vivax;
Anopheles minimus;
Drug resistance;
Transmission dynamics;
Treatment seeking behavior;
Prevention and control

Summary Objectives: The objectives of the study were to define the infectious reservoir of malaria with particular reference to transmission dynamics of *Plasmodium falciparum*, and to ascertain the disease trends in view of the existing containment practices and treatment seeking behavior in malaria endemic communities of Assam, India.

Methods: Cross-sectional surveys were conducted in population groups of malaria endemic districts of the state to determine parasite prevalence, and data were analysed retrospectively for the years 1991-2003 to ascertain the disease trends. Structured questionnaire based surveys were conducted to study the treatment seeking behavior and practices of healthcare providers.

Results: *P. falciparum* and *P. vivax* were the only two parasite species encountered, the former being in the majority (>60%). Malaria transmission was persistent, and a seasonal peak of *P. falciparum* was consistently observed during the months of heavy rainfall (April to September). Among children (5-15 years) there was a significantly higher malaria parasite rate as compared to the <5 years age group and adults (>15 years). There was a decline in parasite rates for all age groups over the years of the study that could not be attributed to vector control intervention intensities and/or meteorological factors.

Conclusions: The persistence of *P. falciparum* is attributed to the emergence of drug resistant varieties, inadequate interventions and treatment seeking patterns, and for its containment focused intervention measures are advocated in partnership with the communities.

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Introduction

Malaria is endemic in the Indian state of Assam, and transmission of the causative parasites is

maintained almost exclusively by *Anopheles minimus*; other vectors are *An. dirus* and *An. fluviatilis*.^{1,2} Malarial outbreaks characterized by enhanced morbidity and mortality are common and reported across the state annually.³ With no effective malaria vaccine on the horizon and rising operational costs, there has been a shift in strategy from eradication to vector control with overall objectives to reduce morbidity and mortality. However, transmission continues and is perceived as a threat to the control programme owing to emergence of multi-drug resistant strains of *falciparum* malaria in the state.^{4,5} The disease is unevenly distributed across the landscape associated with varying intensity of malaria transmission and risk factors.⁶ Of the total of 23 districts, 22 share either an inter-state or international border or both. The population groups in the border areas are considered to be at greater risk and are believed to be infectious reservoirs for persistent transmission of the malaria pathogen. These areas burdened with poverty are the hard-core pockets, and are prone to fulminating outbreaks owing to trans-border migration, inter-mixing of non-immune population groups and inadequate health infrastructure. To strengthen the health services, besides access to healthcare facilities and vector control measures, the study of human behavior is increasingly being recognized as important in disease control programmes.⁷ The objectives of the present investigation were to define the infectious reservoir, and to study treatment-seeking behavior of the people and healthcare access in the malaria endemic communities of Assam, India. In addition, data were reviewed retrospectively for the years 1991-2003 to ascertain the relevant risk factors and the trends of disease transmission.

Materials and methods

Study populations and malaria control measures

The investigations were conducted in the malaria endemic areas of certain districts in the state of Assam (24°44' to 27°45' N latitude; 89°41' to 96°02' E longitude) reporting epidemics of the malaria cases and deaths. The populations in these areas are predominantly tribal aborigines, and most people living in poor socio-economic conditions. Typically, the houses consist of two to three rooms made of bamboo with thatched roofing, and often there are cattle sheds near to the houses. The primary occupation of the inhabitants is paddy cultivation;

others included handloom weaving, collecting forest produce and working for meagre daily wages. Annual rainfall associated with the monsoons is the heaviest in the world, and in the study areas it varied from ~1500 to 2200 mm for the years from 1991 to 2003. Much of it occurs during April-September (wet season), and in rest of the year there is little rainfall. Many villages that are remotely located in the foothills/forest fringe amidst paddy fields are inundated by recurrent floods, and are deprived of primary healthcare facilities, which are usually located in urban areas. The mean monthly relative humidity varies from 60 to 90%, and most of the year is hot and humid (22-33 °C) except November to February (minimum of 10 °C).

Malaria control operations are based on radical treatment of malaria cases deriving from fortnightly active fever surveillance and passive detection (of those self-reporting at the government sponsored clinics), and two rounds of indoor residual spraying of 50% DDT@1 gm/m² annually. The spray operations are routinely conducted during April to September each year corresponding to the peak transmission season, but are restricted to areas reporting at least two cases for every 1000 blood smears checked. Beginning in 1996, other measures included observance of an anti-malaria week in June, and from 1997 onwards the whole month (June of each year) during which programmes on health education/awareness are intensified supported by the media. In addition, training and re-orientation programmes are routinely conducted for all categories of health personnel as capacity building exercises.

Malaria surveys

For estimation of malaria parasite load in the ethnic communities, cross-sectional surveys were conducted in malaria endemic populations of districts of Karbi Anglong, Sonitpur, Darrang, Kamrup, Kokrajhar and Dhubri from 1991 to 1993. A finger prick sample of blood was collected from the participating subjects and was stained with Jaswant Singh and Bhattarcharya (JSB) rapid stain. Both thick and thin blood smears were examined under an oil immersion ($\times 100$) objective for detection of parasite positivity and for species identification, respectively. A total of 100 microscopic fields were scanned before declaring a slide negative. All malaria positive cases were treated with chloroquine (10 mg/kg on day 0 and day 1, and 5 mg/kg on day 2) plus 45 mg of primaquine for *P. falciparum* and 75 mg (15 mg per day for 5 days) for *P. vivax* in

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