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# Malaria in southeast Bangladesh: A descriptive study

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**Abstract**

Malaria in Asia is thought to be grossly under-reported and this is evident from previously published statistics from Bangladesh. Malaria screening data from four Upazillas was analysed alongside census data to assess the trends in malaria incidence over time and distribution of malaria by age and gender. Malaria incidence in this area has decreased by around two thirds since 2003, although control measures were not significantly increased until 2005. Malaria occurred in people of all ages with the highest incidence being in young adults. This is consistent with higher occupational exposure in this group. The probability of being screened for malaria decreased with age suggesting significant numbers of adults with malaria may be being missed.

## Introduction

Although much of the morbidity and 90% of deaths due to malaria are thought to be in Africa, mostly in young children, malaria remains a major cause of morbidity and mortality in Asia. It has been argued that the disease burden due to malaria in Asia is grossly underestimated, partly due to the use of passively collected disease notification data[1]. In Bangladesh, 10 out of its 64 districts (around 17.9 million people) are thought to be highly endemic (>1 case per year per 1,000 population) malaria with highly seasonal transmission. All of these districts are in the east and southeast of the country near to the borders with India and Myanmar (Figure 1). There are wide fluctuations in the annual malaria rates and there has been no evidence of a systematic decline in the national figures from 2001 to the most recent data collected in 2006[2]. In that year, there were an estimated 2.9 million cases of malaria in Bangladesh but only 48,248 laboratory confirmed cases were reported from routine surveillance[2]. There were no reported cases in 2006 in 48 districts, although this is also likely to be due to under-reporting[2].

Much of the highly endemic area is undeveloped with inaccessible, elevated terrain. Its population consists mainly of several hilltribes, and illiteracy is high in the region. There have been significant malaria control efforts in recent years but it is unclear what impact they have had. This study attempts to assess malaria incidence over time in a representative area of Southeast Bangladesh using Health Complex data, and relate this to the implementation of interventions over the same period.

## Methods

Malaria screening data (blood film examination) collected from self-presenting patients at three health complexes and 1 regional hospital covering 4 Upazillas (Ramu, Ukhia and Cox's Bazar Sadar from Cox's Bazar district and Naikhongchhari in Bandarban district – Figure 1) from 1999-2006 was obtained.

This was analysed together with census data from the most recent census of Bangladesh in 2001[3] to examine rates of malaria diagnosis in this region.

*Statistics:* Analysis was performed by Excel 2007 and SPSS version 15.0. Newcombe's difference method for proportions and differences was used to calculate 95% confidence intervals for changes over time and differences between age groups.

## Results

From 1999-2006, there were 307,803 blood samples screened for malaria in the Upazillas and, of these, 11.6% of samples were positive for

*Plasmodium falciparum* and 4.9% for *Plasmodium vivax* i.e. 70.3% of all malaria cases were caused by *P. falciparum*. Mixed infection with both species was found in 0.01% of blood samples screened.

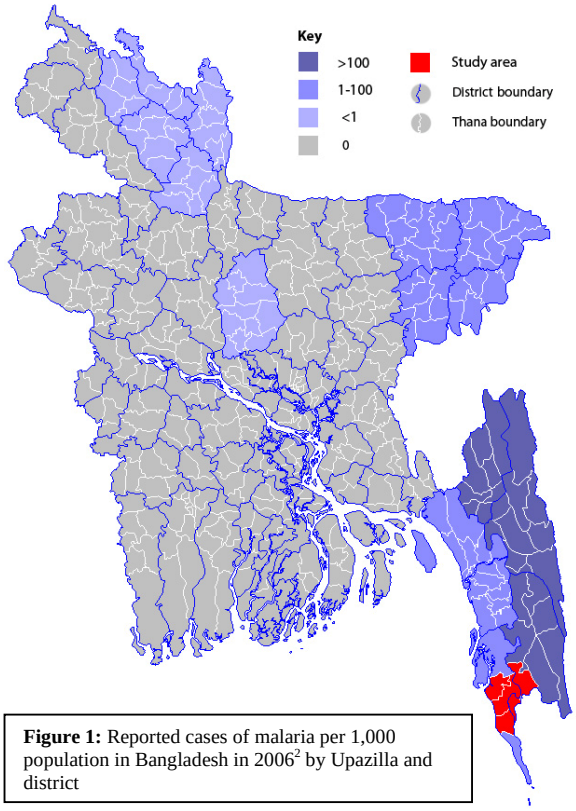


**Figure 1:** Reported cases of malaria per 1,000 population in Bangladesh in 2006[2] by Upazilla and district

Overall, 16.5% of screens were positive. Out of the whole population, the annual screening rate was 50 screens/1000 persons (range 30-140) (Table I) with annual parasite incidence rates (API) of 5.9/1000 for *P. Falciparum*, 2.5/1000 *P. Vivax* and 0.0065/1000 for mixed infection.

Overall API was 8.4/1000 persons. If applied to an at risk population of 17.9 million, this rate gives an annual number of malaria cases of 150,360 for high transmission areas of Bangladesh. The annual number of screens positive for malaria from 1999-2006 is shown in Figure 2.

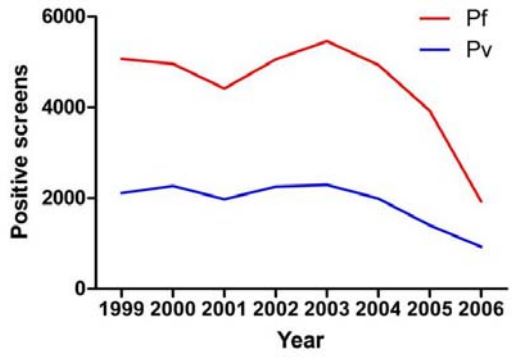


**Figure 2:** Annual screens positive for malaria, 1999-2006

Incidence rates were constant from 1999 to 2002. From 2003 to 2006, however, the rates for *P. Falciparum* decreased by 64.8% (95% CI 61.7-67.8%) and *P. Vivax* decreased by 59.7% (95% CI 54.8-64.5%).

Of those screened, 58.2% were male and the mean age was 18.5 years. Those positive for *P. Falciparum* had mean age of 17.5 years and 60.8% were male. Those with *P. Vivax* had mean age of 16.6 years and 58.3% were male. 49.3% of those with malaria were under 15 years of age whereas 39% of the general population were in this age group. The overall age structure of the *P. falciparum*-infected population is shown in Figure 3.

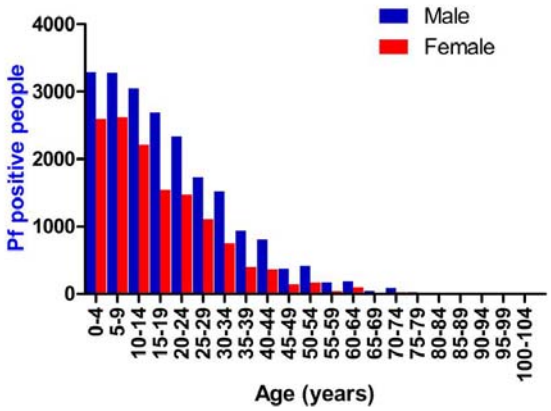


**Figure 3:** Age and sex distribution of *P falciparum* infected people (data for 1999-2006)

The total malaria screens for 1999 to 2006, by age group, are shown in Figure 4.

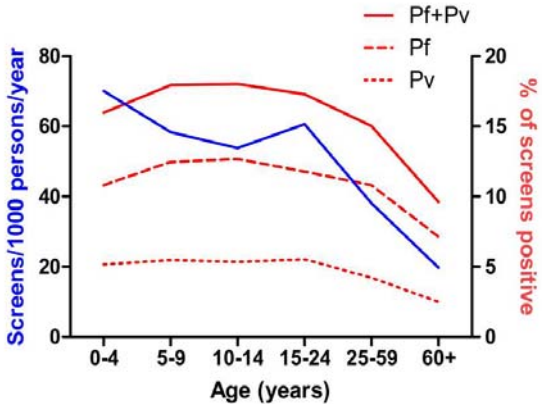


**Figure 4:** Malaria screening rates by age group (data for 1999 to 2006)

The probability of being screened for malaria decreases with age by 71.8% (95% CI 71.0-72.6%) from the 0-4 years group to the 60+ years age group. Children 5-14 years of age are the most likely to have a positive screen and the 60+ years age group are the least likely (46.6% (95% CI 42.4-50.9%) less than 10-14 year olds).

**Table I:** Population size and screens for malaria by Upazillas, 1999-2006

| Upazilla | Ramu | Naikhongchhari | Ukhia | Cox's bazar sadar | All |
|---|---|---|---|---|---|
| Source of data | Health complex | Health complex | Health complex | Hospital | |
| Population | 202,683 | 49,465 | 155,187 | 348,075 | 755,410 |
| Malaria screens | 119,557 | 54,565 | 49,844 | 83,835 | 307,801 |
| Screens /1,000 persons/year | 70 | 140 | 40 | 30 | 50 |

## Discussion

In the 4 Upazillas included in this study, the API for malaria was 8.4/1,000/year. This gives a conservative estimate of total malaria cases in high transmission areas of Bangladesh more three times higher than the reported number for the whole country in 2006. This is despite not allowing for the even higher incidence rates further inland from the areas in the study[2].

This is yet more evidence of the gross under-reporting of malaria cases in Asia. In addition, it is highly likely that a large number of people with malaria in this region receive treatment without confirmation by peripheral blood examination. These patients are not included in the official notification rates.

The numbers of positive screens have declined by nearly two thirds since 2003. Significant additional control measures were not introduced in this area until 2005 so it is unclear why the reductions in malaria incidence in 2003-2004 and 2004-2005 occurred. In 2005-2006, the decline in malaria incidence accelerated, as would be expected with the introduction of additional control measures. Those control measures introduced around this time included a malaria control Behavioural Change Communication strategy, a change from chloroquine to artemether/lumefantrine as first line treatment for uncomplicated malaria from 2005 and distribution of insecticide treated bed nets into selected areas in 2006.

The probability of an individual being positive for malaria decreased with age, although over half of those infected are 15 years or older. As the screening results in this study were all from self-presenting symptomatic patients this suggests that more than half of symptomatic patients with malaria in this region were age 15 years or older. This is consistent with the relatively low transmission intensity in Bangladesh, as compared to sub-Saharan Africa, which is unlikely to confer antimalarial immunity. High incidence rates in young adults can probably be attributed to a high level of exposure in this group, e.g., related to work in the forests. In areas of high transmission, immunity is stimulated to such an extent that almost all symptomatic cases of malaria are young children.

It was also found, however, that the probability of being screened for malaria at all also decreases with age. This may indicate that adults are less likely to present to health facilities with symptoms suggestive of malaria or that significant numbers of them are falling through the screening net.

Limitation of the study include that, although it comprises a large number of patients, they represent a relatively small and specific area of the malaria endemic regions in Bangladesh. Extrapolation of results to elsewhere in the region should therefore be applied with caution. This study was supported by CDC, Directorate General Health Services, Dhaka, Bangladesh.


### Acknowledgements

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