



## RESEARCH NOTE

# Prevalence of malaria infection among under five year tribal children residing in malaria endemic forest villages [v1; ref status: awaiting peer review, <http://f1000r.es/4n4>]

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**v1** First published: 20 Nov 2014, 3:286 (doi: [10.12688/f1000research.5632.1](https://doi.org/10.12688/f1000research.5632.1))  
Latest published: 20 Nov 2014, 3:286 (doi: [10.12688/f1000research.5632.1](https://doi.org/10.12688/f1000research.5632.1))

## Abstract

Malaria is a life-threatening protozoal infection and India has the highest malaria burden in South East Asia. The objective of this communication is to assess the prevalence of malaria infection amongst forest dwelling tribal children under the age of five residing in malaria endemic regions of the Andhra Pradesh and Chhattisgarh states of India. A total of 5,801 children attended seven outpatient mobile clinics in 2012. Of them, 2,123 children had a history of fever and were screened for malaria with a Rapid Diagnostic Test (RDT). About 37% of children had a history of fever. Of them, 34% children were diagnosed with malaria. The majority (66%) of children with a positive RDT had a mixed malaria infection of both *Plasmodium falciparum* and *P. vivax*, followed by single infections of *P. falciparum* (18.9%) and *P. vivax* (14.2%). Malaria infection is a major public health concern amongst the tribal children residing in these malaria endemic forest villages. Therefore, region specific sustainable intervention measures need to be initiated for the prevention and control of malaria and malaria related deaths in this region.

## Open Peer Review

Referee Status: AWAITING PEER

REVIEW

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**How to cite this article:** Qureshi I, Qureshi MA, Gudepu RK and Arlappa N. Prevalence of malaria infection among under five year tribal children residing in malaria endemic forest villages [v1; ref status: awaiting peer review, <http://f1000r.es/4n4>] F1000Research 2014, 3:286 (doi: [10.12688/f1000research.5632.1](https://doi.org/10.12688/f1000research.5632.1))

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**Grant information:** The author(s) declared that no grants were involved in supporting this work.

**Competing interests:** No competing interests were disclosed.

**First published:** 20 Nov 2014, 3:286 (doi: [10.12688/f1000research.5632.1](https://doi.org/10.12688/f1000research.5632.1))

## Introduction

The World Health Organization reported 219 million cases of malaria with an estimated 660,000 deaths. South East Asia is the second most affected region in the world after Africa, and India has the highest (61%) malaria burden in the region with an estimated 24 million cases per year. *Plasmodium falciparum* malaria continues to be a major public health threat in India, with nearly half (273 million) of the high risk population outside Africa residing in India<sup>1</sup>. India contributes over one fifth (22.6%) of clinical episodes of *P. falciparum* globally<sup>2</sup>. About 80% of malaria cases reported in the country is confined to areas consisting of 20% of the total population, who reside in tribal, hilly, difficult and inaccessible areas<sup>3</sup>. In India, malaria is predominantly reported among the tribal population owing to about 80% of malaria cases and overall 97% of deaths<sup>4</sup>. Keeping in view the magnitude of malaria burden among the forest dwelling tribal population in India, this communication was prepared with the objective to assess the prevalence of malaria among forest dwelling tribal children under the age of five residing in northern Andhra Pradesh and the southern part of Chhattisgarh states. This region is a remote hilly and forested area inhabited by various Naxalite (communist guerrilla) groups and there is a constant conflict with local governments leading to security restrictions. Primary health centres (PHCs) are sparsely located in forest villages. To avail the health care services, they need to travel on foot for long distances as there is no proper transport infrastructure. The tribal population of this region have poor access to modern health care and are vulnerable to under-nutrition, malaria and other communicable diseases. Medecins Sans Frontieres (MSF) has been providing primary health care and emergency services to the tribal population through mobile health clinics.

## About Medecins Sans Frontieres (MSF) India

MSF India's teams make available basic healthcare, antenatal and postnatal care, vaccinations and treatment for diarrhoea, tuberculosis, and malaria to tribal populations residing in adjoining tribal forest villages of northern part of Andhra Pradesh and southern part of Chhattisgarh states<sup>5</sup>.

## Methods

Retrospective secondary data collected by MSF on malaria during January 2012 to December 2012 from seven mobile clinics (Table 1) was utilized for this communication. A total of 5,801 children under the age of 5 attended as out-patients at mobile health clinics during 2011–12. All children with history of fever were screened for malaria infection with a finger prick Rapid Diagnostic Test (RDT) kit (SD 05FK60 RDT). A three day course of anti-malarial treatment with the combination of Artemether + Lumefantrine based on body weight was initiated for children who tested positive. Data was analysed using SPSS version 19<sup>6</sup>. Descriptive statistics were calculated to assess the prevalence malaria infection in different clinic areas. Therefore, to study the difference in the prevalence of malaria infection between clinic areas generalised estimable equation was applied. A p-value of <0.05 was considered statistically significant.

## Results

A total of 5,801 under five year children attended the outpatient mobile clinics. Of them, 36.6% of children had history of fever. Based on the RDT data, the prevalence of malaria was 34.1% among children suffering from fever, and significant differences were observed in prevalence of malaria infection between the mobile clinics ( $p < 0.001$ ) (Table 1).

Among the children with positive RDT, about 66.8% were diagnosed with mixed malaria infection indicating the presence of both *P. falciparum* and *P. vivax* malaria, while the proportion of children with *P. falciparum* and *P. vivax* malaria infection was 18.9% and 14.2%, respectively. Thus, about 85% of children with malaria were infected with *P. falciparum*, which ranged from 67.7% in the Tippapuram mobile clinic to 92.2% in Pusuguppa. However, a higher prevalence of *P. vivax* (95.4%) was reported among the children of Tippapuram (Table 2).

## Discussion

The prevalence of malaria infection is a major problem of public health significance among the tribal children residing in these hilly

**Table 1. Data of under 5 year children with suspected malaria fever and positive RDT†.**

Clinic Area	Consultations (<5 Years)	Malaria infection (Suspects)		Malaria Positives (Positive RDT)	
	N	n	Percent	n	Percent
Maita	330	118	35.8	40	33.9
Mallampeta	1026	345	33.6	117	33.9
Dharmannapeta	898	319	35.5	105	32.9
Pusuguppa	767	329	42.9	115	35.0
Tippapuram	664	208	31.3	65	31.3
Yampuram	1223	421	34.4	137	32.5
Puttapalli	893	383	42.9	144	37.6
Total	5801	2123	36.6	723	34.1

†Rapid diagnostic test.  $p < 0.001$

**Table 2. Distribution (%) of children under the age of five by type of malaria and area.**

Clinic Area	Malaria Positive (RDT Positive)	Type of Malaria		
	N	<i>P. falciparum</i> Percent (n)	<i>P. vivax</i> Percent (n)	Mixed Percent (n)
Maita	40	20.0 (8)	15.0 (6)	65.0 (26)
Mallampeta	117	17.9 (21)	17.9 (21)	64.1 (75)
Dharmannapeta	105	27.6 (29)	10.5 (11)	61.9 (65)
Pusuguppa	115	16.5 (19)	7.8 (9)	75.7 (87)
Tippapuram	65	4.6 (3)	32.3 (21)	63.1 (41)
Yampuram	137	21.2 (29)	12.4 (17)	66.4 (91)
Puttapalli	144	19.4 (28)	12.5 (18)	68.1 (98)
Total	723	18.9 (137)	14.2 (103)	66.8 (483)

Figures in the parenthesis are numbers.

and remote forest villages where malaria is endemic. Qureshi *et al.* have previously reported high prevalence of malaria among pregnant women in this study area<sup>7</sup>. In general, a majority (85%) of children with malaria infection were infected with *P. falciparum*. Similar findings were reported by Sahu *et al.* among tribes of the Koraput district of Odisha State, India (89% in 1–14yr, and >14 age categories)<sup>8</sup>, and Gahutu *et al.* in Rwanda (15–21% in under five year olds)<sup>9</sup>. As reported by the National Vector Borne Disease Control Programme (NVBDCP), around 50% of total malaria cases reported was due to *P. falciparum*<sup>3</sup> in India. Similarly, as per the Strategic Action Plan for Malaria Control in India 2007–2012, the prevalence of *P. falciparum* has gradually increased from 38.8% in 1995 to 50% in 2008<sup>10</sup>. The NVBDCP Epidemiological report of 2013–14 was also reported the prevalence of *P. falciparum* infection in Andhra Pradesh as 68.85% in 2013 and 74.60% by September, 2014, while the corresponding figures for the neighbouring state of Chhattisgarh were 78.80% and 84.26%, respectively<sup>11</sup>. One of the reasons attributed to the rise in proportion of *P. falciparum* cases is resistance to chloroquine, which was used for a long time as the first line of treatment in malaria cases<sup>1</sup>.

The prevalence of malaria among the children of under the age of five was high in this present study. Similar, findings were reported among children under the age of five in Angola<sup>1</sup> and Rwanda<sup>9</sup>. The prevalence of malaria infection among the children under the age of five is around 20% in Angola and 16.7% in Rwanda. The NVBDCP has undertaken appropriate intervention measures such as introduction of artemisinin combination therapy (ACT) and long lasting insecticidal nets (LLINs) across India including malaria endemic forest areas. In spite of RDT and introduction of ACT, insecticide treated nets (ITNs) and LLINs in 2010, the prevalence of *P. falciparum* malaria continues to be very high in this study area. The WHO has categorised India under the countries where malaria is in the ‘under control’ phase, while neighbouring Sri Lanka is categorised in countries in the ‘under elimination’ phase<sup>1</sup>. Thus, India needs to

do lot to reach at least the elimination phase, let alone the eradication of malaria.

Malaria infection is a significant public health concern among the tribal under five year olds residing in malaria endemic forest villages of the northern part of Andhra Pradesh and southern part of Chhattisgarh states. Therefore, it is imperative to initiate appropriate area specific and sustainable intervention measures including early diagnosis and treatment of all individuals with suspected malaria fever, interruption of malaria transmission in the community and prevention of drug resistance by rational use of anti-malarial drugs. More specifically, RDT coverage should be expanded to all the malaria endemic areas for early detection of cases, improve the effectiveness of Indoor Residual Spray (IRS) and use of ACT for all *P. falciparum* cases throughout the country and increase the human resources at all levels for better surveillance of the disease. It is also important that the community needs to be involved through inclusion of grass root health workers such as Accredited social health activists (ASHAs) and community health workers<sup>12</sup>. Health education through IEC (Information, Education and Communication) activities and behavioural change communication (BCC) are also very important intervention measures aimed at improvement of environmental sanitation and personal protection from mosquito bites for the elimination of malaria in the endemic areas as well as in the whole country.

#### Limitation of the study

This manuscript is prepared utilizing retrospective secondary mobile clinic based data. As demographic information, such as gender and age of the subjects is not available, we could not analyze the data to study possible associations.

#### Ethical considerations

Ethical clearance was not obtained as this communication is based on (secondary) data from a mobile clinic out-patient database. We thank MSF for providing such data.

### Author contributions

IQ, MQ and NA conceived the plan for the preparation of the article. IQ, RG, and NA analysed the data. All the authors interpreted the data and drafted the article. All authors revised the article and gave the final approval for publication.

### Competing interests

No competing interests were disclosed.

### Grant information

The author(s) declared that no grants were involved in supporting this work.

### Acknowledgements

We thank MSF-India for parting the data on malaria. We also thank Mr. G.Manohar Reddy, Scientist B, National Nutrition Monitoring Bureau (NNMB), Hyderabad for his help in statistical analysis of data.

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