

A Study on Role of Temperature for Malaria Transmission in Assam

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Abstract

Malaria is a mosquito borne disease caused by plasmodium parasite and transmitted by the bite of infected mosquitoes. Malaria is life-threatening disease in Assam. Only female mosquitoes spread the malaria parasites. Malaria also keeps children from going to school, families from investing in their future and communities from prospering. In 2018 an estimated 228 million cases of malaria occurred worldwide. Most area in Assam are considered high risk for malaria because of its physiographic condition. Malaria infects all month of a year in Assam but it varies from time to time and place to place. Controlling malaria in the forest areas of Assam has remain a challenge from past. Various factors like topographical, environmental and climatic factors control the number of malaria infected case in the study area. Temperature has influential role for malaria transmission in the study area. This study will explain the correlation between malaria cases and temperature in Assam. The main objective of this study is to investigate the number of malaria cases in Assam and relation between maximum temperature and minimum temperature with malaria cases. Secondary data from various sources have been collected for this study. Simple linear regression and correlation were applied to analyze correlation between temperature and malaria case by using R version 2.6.2. To draw meaningful conclusion relevant statistical tool like MS-excel was used to perform statistical calculations. Correlation analysis showed that minimum temperature is strongly correlated with positive malaria case in the study area. Special measures are necessary to prevent the transmission of malaria in the study area.

Introduction

Malaria is infectious disease caused by protozoan parasites of the genus plasmodium and transmitted by the bite of infected female anopheles mosquitoes in many parts of the world.

Malaria is one of the most devastating parasitic diseases affecting human life. Malaria has become endemic and subject to intention in most parts of the world as, currently, it kills 1.5 to 3 million people every year. Approximately 3.2 billion people in 108 countries located in tropical and sub tropical region of the world are living in malaria risk area in which 1.2 billion are at high risk of malaria disease (WHO, 2014). WHO South-East Asia region have eleven countries including India and nine of those countries are malaria endemic. Despite large-scale global efforts to eradicate malaria in the last few years, it still remains a major public health burden with an estimated 219 million cases and 435,000 deaths worldwide in 2017.

India contributes heavily through the number of reported malaria cases in South East Asia region by contributing 58 per cent of the malaria cases. India cases are reported through the year. India witnessed the highest malaria incidence of an estimated 75 million cases and 0.8 million deaths per year in the 1950s. National Malaria Control Program (NMCP) launched in 1953 significantly declined the malarial incidence rate to <50,000 and no reported mortality, by the year of 1961. Despite the elimination, malaria again rises back strongly in 1976 with the incidence rate of 6.45 million cases. In India *p. falciparum* causes 30-90 per cent of the malarial case in Orissa, Madhya Pradesh and in North Eastern states. The geographical area where 'high-risk population' resides includes seven north east states (Peterson, 2009).

North East India is highly malaria endemic with *p. falciparum* being the most predominant one including the state of Assam. North East India contributes 7.8 per cent of malaria cases and 21.8 per cent of malaria deaths reported in the country in 2012. Topography and temperature condition plays a vital role in North East India for transmission of malaria. As of 2018, the seven North Eastern states accounts for 15.2 per cent of the total malaria case in India. Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Sikkim,

Manipur and Tripura make up the eight states of North East India and Sikkim is mostly malaria free. Successful malaria intervention strategies in the North East are critical for India's target to eliminate malaria by 2030 (Paradial, 2010).

Assam has high relative humidity (60-80%) throughout the year facilitates the proliferation of the disease vectors and permits the active transmission of the causative parasites. Assam with only 2.6 per cent of country's population records 9 per cent of total malaria cases in the country (Dev and Sharma, 1995). People of Assam have poor socio-economic condition and lower health care facilities in rural area. The highly endemic and malaria affected district are Karbi-Anglong, Dima Hasao, Hailakandi, Kokrajhar, Chirang, Darrang, and Goalpara. In recent time National Rural Health Mission has reduced the severity of the disease with less number of cases per year (Prakash et al, 2003). For the transmission of malaria temperature plays a vital role in Assam. Therefore the present study entitled '*Role of Temperature for Malaria Transmission in Assam*' has been taken for investigation.

Objectives of the study

Based on the background outlined above, the objectives for the proposed study are:

- (i) To study about the malaria incident case in Assam
- (ii) To investigate the relationship between temperature and malaria in the study area

Study area

Assam is a state in North East India, situated south of eastern Himalayas along the Brahmaputra and Barak river valleys. Assam covers an area of 78,438 square kilometers and support population of 31,169,272 persons according to 2011 census. Study region lies approximately between 24°8' north to 28°2' north latitudes and 89°42' east to 96° east longitudes. Assam is bordered by Bhutan and Arunachal Pradesh to the north, Nagaland and Manipur to the east, Meghalaya, Tripura, Mizoram and Bangladesh to the south and West Bengal to the west. With the tropical monsoon climate, Assam is temperate (summer maximum 35-38 °C and winter min 6-8 °C) and experiences heavy rainfall and high humidity. Following figure will show the location of Assam (Fig.1)

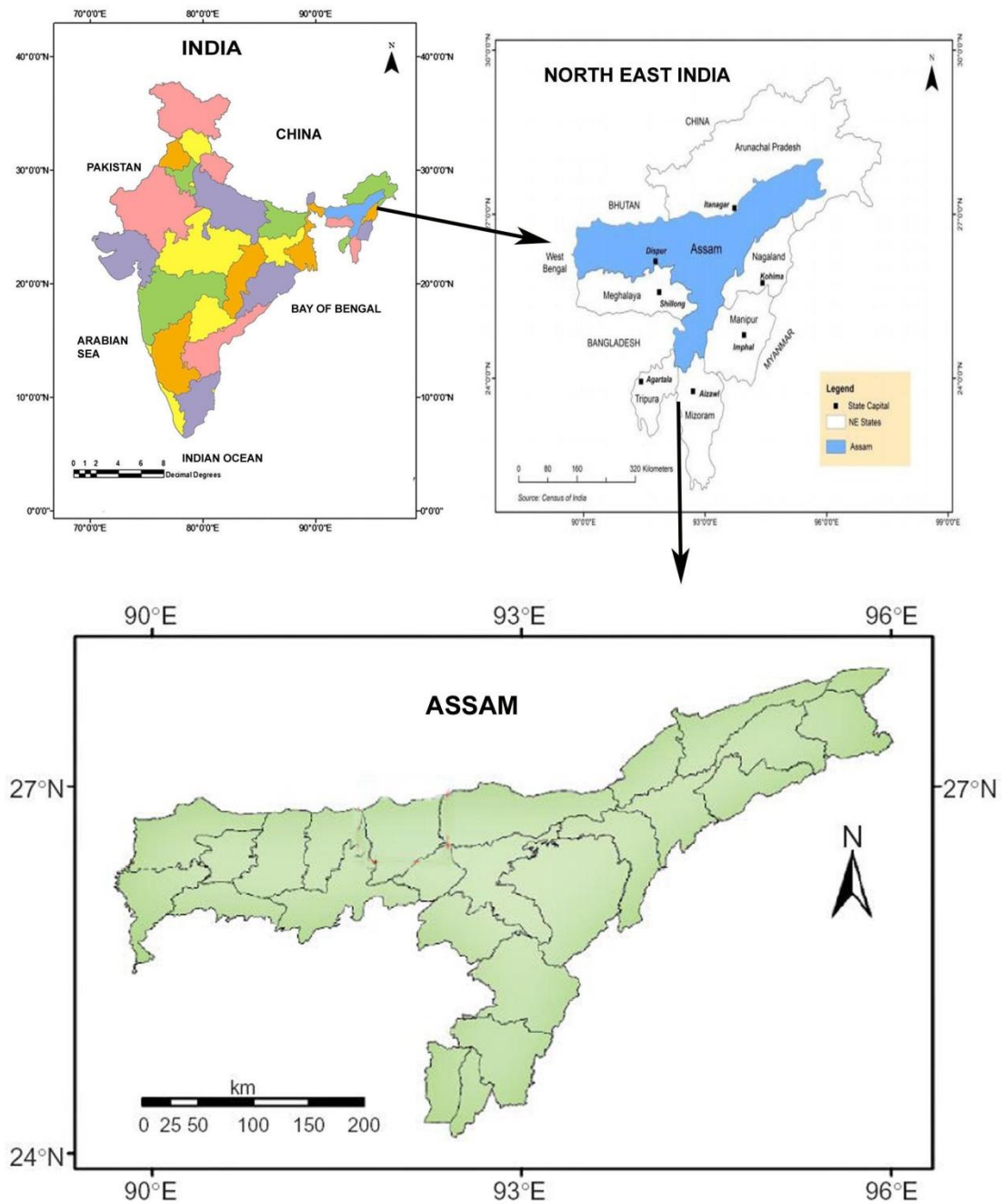


Figure1: Location of the study area, 2020

Methodology and database

This study is based on secondary data. Data regarding monthly distribution of malaria cases were collected from State Health Directory of Assam. Monthly maximum temperature and minimum temperature of Assam was collected from meteorological office. Correlation and regression analyze was done to study the relation between maximum and minimum temperature with malaria case. For statistical analyze R soft ware and MS-Excel was used.

Result and Discussion

Malaria Distribution in Assam

Malaria is one of the major health problems for the public of Assam. In 2015 number of malaria conform cases across Assam was 15,557 persons. Malaria cases recorded in 2016 was 7,826 persons .Number of malaria conformed cases in 2017 was 5,281. In 2018 malaria conform cases was 3,816 and in 2019 it was 1,459. Malaria conform cases in Assam gradually reduces from 2015 to 2019. In Assam there is seasonal and inter-annual variation of malaria conform cases. The highest values of monthly malaria cases were found Jun, July and August month and on the other hand in December and January low numbers of malaria cases recorded. Figure 2 will show the monthly distribution of malaria cases in Assam, 2015-2019.

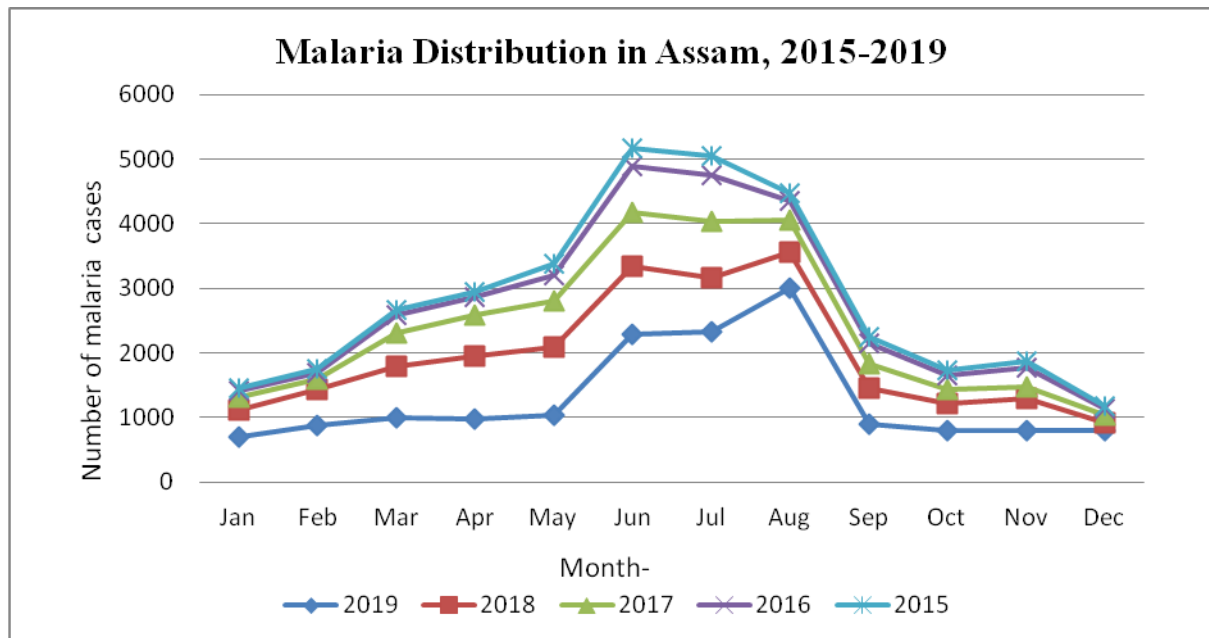


Fig2: Distribution of monthly malaria cases in Assam, 2015-2019 (Data source: State Health Directory of Assam)

Temperature in Assam

January is warm winter month in Assam with average temperature fluctuating between 10.5⁰ C and 23.6⁰C. Average high temperature of the month 23.6⁰C and average low temperature is 10.5⁰C. January is the coldest month in Assam. February is the last month of winter and moderately hot month. In February, the average high temperature is relatively the same as in January. March is the first month of pre-monsoon summer and moderately hot month. Average temperature of March fluctuating between 29.9⁰C and 15.7⁰C in Assam. April is a tropical pre monsoon summer month with average temperature fluctuation between 19.9⁰C and 30.7⁰C. May is the last month of pre-monsoon summer. Temperature in this month is an average low of 22.4⁰C and average high of 31⁰C. Jun is the first month of rainy season and also a hot month with average temperature fluctuating between 24.8⁰C and 31.9⁰C. July is another hot rainy season month in Assam with temperature in the range of an average low of 25.3⁰C and an average high of 31.7⁰C. August is another hot rainy season month with temperature in the range of an average low 25.4⁰C and average high of 32.1⁰C. September is the last month of rainy season with average temperature fluctuating between 31.4⁰C and 24.4⁰C. October is the first month of post monsoon autumn. Average temperature of October month is ranging between 21.9⁰C and 30.2⁰C. November is the last month pre monsoon autumn. The temperature of November is in the range of an average high of 27.5⁰C and an average low of 16.8⁰C. December is the first month of winter and also a moderately hot month with average temperature fluctuating between 11.80C and 24.40C. Figure 3 will show temperature in Assam, 2015-2019.

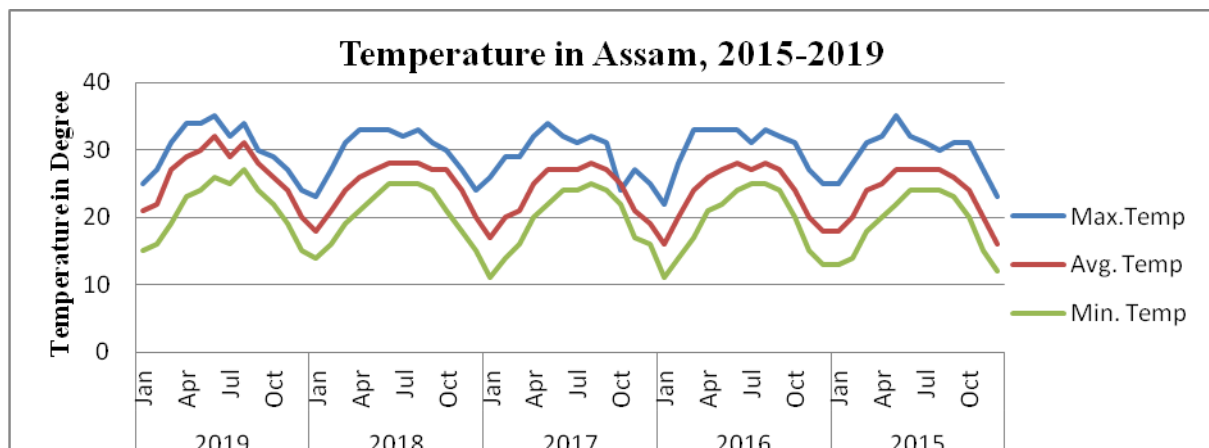


Fig3: Temperature in Assam, 2015-2019

Correlation analysis between temperature and malaria in Assam

Correlation analysis is used to observe the strength of association between malaria cases and temperature in the same month with maximum and minimum temperature in the study area. Temperature is considered as 'X' and number of Malaria case is considered as 'Y' for correlation analysis. In the study area 'r' value is closer to 1 which indicates a strong relation between temperature and malaria case. When temperature increase the number of malaria cases also increases in the study area. In 2015 'r' value for minimum temperature is 0.68 and for maximum temperature is 0.63 which indicate that minimum temperature is strongly associated with malaria than maximum temperature. For the year 2016 'r' value for minimum temperature is 0.68 and for maximum temperature is 0.63 that means minimum temperature is strongly associated with number of malaria case. In 2017 'r' value for maximum temperature is 0.80 and for minimum temperature is 0.66. For the year 2018 and 2019 'r' value for minimum temperature is 0.78 and 0.69 while for maximum temperature 'r' value is 0.66 and 0.63 respectively. Therefore from 'r' value we can state that minimum and maximum temperature is strongly associated with number of malaria case in the study area and minimum temperature is more associated than maximum temperature. In the study area during the maximum temperature period malaria cases increase and during low temperature month malaria cases decrease.

The epidemic from of malaria observed in 2015 in Assam when the condition malaria transmission were suitable, but community awareness about malaria preventive and treatment activity were low at that time. Presently Government has introduces many preventive measures to control malaria in the study area. When the temperature increases malaria transmission also increase because high temperature is suitable for mosquitoes. The National Rural Health Mission a scheme of Government of India that aims at providing valuable healthcare services to rural household all over the country is giving special attention to eight backward states of the country, among which Assam is also one. It was launch in 2005 for a period of seven years. Fig4 will show relationship between temperature and malaria in the study area.

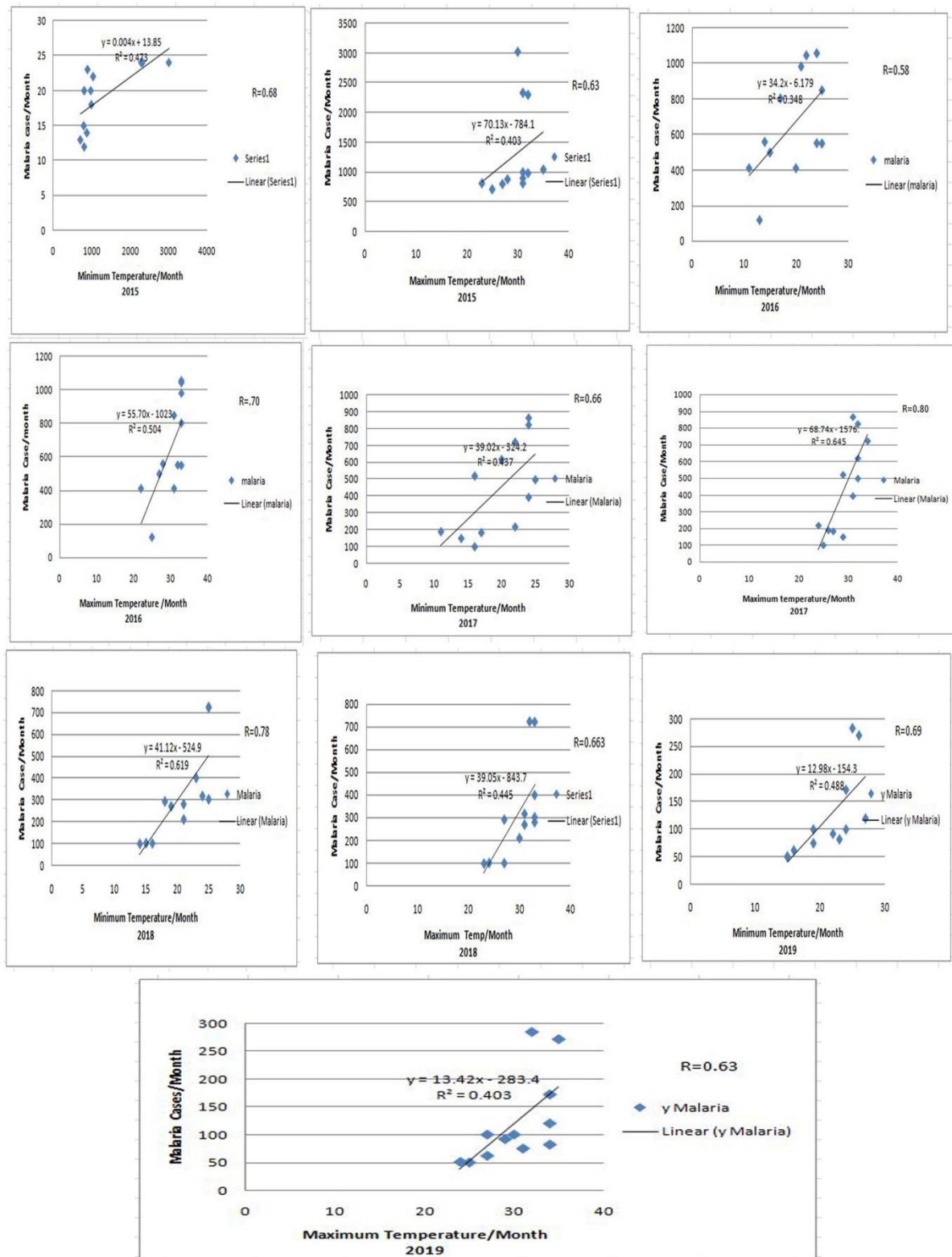


Fig4: Relationship between minimum and maximum monthly temperature with monthly malaria cases

Simple linear regression analysis showed that at the same month minimum temperature positively associated with number of malaria case in Assam. For this study temperature is basic climatic factor for malaria transmission. Therefore, increase of minimum temperature would change the transmission of malaria in Assam.

Conclusion

Temperature has contribution for malaria transmission in the study area. Malaria case has positively correlated with temperature as 'r' value is closer to 1. From the correlation and regression it become clear that in Assam there is positive relation between malaria and temperature. When temperature increase malaria transmission also increase in Assam. The current month temperature may contribute to the next month malaria transmission. Minimum temperature seems the best malaria predictor as it is strongly associated with malaria case. Important measure for prevention of malaria is bed net distribution among people in the study area.

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