Correlating Malaria Parasite Prevalence with Slide Positive Rates and Annual Parasite Incidence in Bareilly Districts

Manoj Gupta

Department of Zoology, Upadhi Mahavidhyalya,

Pilibhit

Email: drmanojguptaumv@gmail.com

****

ABSTRACT

This study digs into malaria rates by measuring both the Spleen Rate (S.P.R.) and the Annual Parasite Incidence (A.P.I.). Plasmodium vivax (Pv) infections turned up in nearly every area surveyed. Plasmodium falciparum (Pf), on the other hand, showed up only at low levels in a few spots during the study. When comparing regions, one rural area stood out with the highest S.P.R., while a different rural area posted the highest A.P.I. over the same time frame

Keywords: *Malaria prevalence, Spleen Rate (SPR), Annual Parasite Incidence (API), Plasmodium vivax, Plasmodium falciparum, Rural health, Epidemiological survey, Parasite distribution, Malaria surveillance, Endemicity.*

****

INTRODUCTION

Malaria is far more than just another example of a vector-borne illness; it is a disease deeply embedded within the tapestry of human history, shaping societies and challenging medical science for centuries. Its persistence is not simply due to a single factor, but rather to a complex interplay of biological, environmental, and social forces. The Plasmodium parasite, transmitted by Anopheles mosquitoes, finds its way into human hosts, all the while being influenced by myriad environmental variables—from temperature and rainfall patterns to the presence of breeding habitats and changes in land use. Chatterjee (1976) emphasized that malaria's severity and distribution cannot be attributed to any one element; instead, it emerges from the multifaceted relationships among pathogens, vectors, people, and their surroundings.

When examining the dynamics of malaria transmission, it becomes apparent that every detail is significant. The landscape itself—its geography and topography—can determine where mosquitoes breed and how far they travel. Climate is equally critical, with temperature and

humidity directly affecting mosquito survival and the development of the parasite within the insect. The diversity of mosquito species in an area, their flight ranges, feeding schedules, and resting preferences all contribute to the local patterns of disease. As Chatterjee (1976) outlines, these factors do not operate in isolation but intertwine to create unique local epidemiologies. This complexity means that malaria is inherently a 'local' disease. Its incidence and prevalence can vary dramatically not only between distant regions but even between neighboring districts or neighborhoods within the same city (Anon, 1996). Local differences in living conditions, infrastructure, and access to healthcare further compound these disparities.

A central question that has puzzled researchers is what sustains malaria transmission over time. While there is ongoing debate, some studies suggest that rural populations play a critical role as reservoirs of infection, maintaining the presence of the parasite even when control efforts intensify (Kumar, 1997). These reservoirs can be particularly challenging to address due to factors such as limited healthcare access, agricultural practices that create breeding sites, and mobility between villages and urban centers. Such spatial 'patchiness' is also reflected in temporal patterns. For instance, a detailed survey conducted around the BHEL area in Hardwar found that malaria infections surged in September, likely in response to post-monsoon conditions favorable for mosquito proliferation, before dropping to their lowest levels in December (Chopra and Kumar, 1987). Furthermore, the study reported that Plasmodium vivax was more prevalent than Plasmodium falciparum in this region, a distinction with significant implications for both treatment protocols and control strategies. Plasmodium vivax, for example, can form dormant liver stages, complicating eradication efforts and necessitating different therapeutic approaches.

Seasonal fluctuation in malaria incidence is a consistent theme in contemporary research as well. Sharma et al. (2002), investigating malaria in Jaipur, observed that case numbers began to rise sharply just after the rainy season, tying the surge to increased mosquito activity and the availability of breeding sites filled by monsoon rains. Their analysis, using epidemiological metrics like Slide Positivity Rate (SPR) and Annual Parasite Incidence (API), revealed pronounced spikes immediately following the rains, underscoring the strong link between climate and malaria transmission cycles. This relationship between rainfall and malaria is not only relevant for predicting outbreaks but also for planning timely interventions, such as indoor residual spraying or the distribution of insecticide-treated bed nets.

Collectively, these studies reinforce a crucial point: truly effective malaria control demands a nuanced understanding of how the disease operates at the ground level. National or regional

strategies, while important, must be complemented by localized surveillance and tailored interventions that account for the unique ecological and social realities of each community. Without this granular perspective, efforts may miss hidden hotspots or fail to address the specific drivers of transmission. Recognizing this, the present study aims to provide a detailed examination of malaria epidemiology in various neighbourhoods of Bareilly District. By mapping out the specific factors influencing transmission in these localities—whether environmental, entomological, or socio-economic—the research seeks to equip public health authorities with the precise data they need. Ultimately, such targeted knowledge is essential for designing interventions that are not only scientifically sound but also contextually appropriate, maximizing the impact of malaria control programs where they are needed most.

Material and Methods

A monthly survey was conducted in selected study areas to assess malaria prevalence. Blood samples were collected through finger pricks from individuals showing symptoms of malaria, as well as through visits to Primary Health Centers (PHCs) in the chosen localities. With assistance from malaria control personnel, both thick and thin blood smears were prepared and stained using J.S.B. and Leishman's stain (Chatterjee, 1980). Two mass blood surveys were carried out—one during the low transmission season and another during the peak transmission period—to monitor malaria prevalence in the study area. Parasite species were identified, and parasite counts were performed. To understand the epidemiological aspects of malaria and the role of specific Anopheles species (*An. fluviatilis*) in disease transmission, support was obtained from the District Malaria Officer, Bareilly. The Slide Positive Rate (S.P.R.) and Annual Parasite Incidence (A.P.I.) were calculated for different localities using the formulas below:

$$\text{S.P.R.} = \frac{\text{Total number of blood smear positive}}{\text{Total number of blood smear examined}} \times 100$$

$$\text{A.P.I.} = \frac{\text{Total number of blood smear positive}}{\text{Total population of study area}} \times 1000$$

Results

Nawabganj Locality

During the course of the study, Nawabganj experienced a significant and concerning escalation in malaria transmission. The research team intensified their surveillance efforts by examining nearly double the number of blood smears compared to the baseline period, thus enhancing the accuracy and sensitivity of malaria detection. However, the dramatic increase in positive cases—from 81 to 246—cannot be explained by increased testing alone. This

nearly threefold surge in confirmed infections signals an actual intensification of malaria transmission in the community. As a result, the Slide Positive Rate (SPR) rose sharply from 1.77% to 3.16%, reflecting a higher proportion of individuals testing positive among those screened. The Annual Parasite Incidence (API), which indicates the number of new malaria cases per thousand people per year, also saw a steep rise, jumping from 0.46 to 1.42. This uptick in API underscores a growing public health threat, suggesting that the local population is facing a much higher risk of contracting malaria than before. Another notable trend in Nawabganj is the shifting balance between the different malaria parasites. Both *Plasmodium vivax* (Pv) and *Plasmodium falciparum* (Pf) were present in the locality, but there was a relative increase in the proportion of Pf cases over the study period. Since Pf is known to cause more severe and complicated forms of malaria, its growing prevalence signals a potential shift towards more dangerous malaria outbreaks. This change might result from multiple factors, such as evolving parasite ecology, changing environmental conditions, or even the impact of local interventions and drug resistance patterns. The observed increase in Pf cases not only alters the clinical profile of malaria in Nawabganj but also suggests that future control efforts may need to prioritize Pf-specific strategies to prevent severe disease and fatalities.

Baheri Locality

In Baheri, and especially at its Mudia and Shergarh sites, malaria demonstrated an entrenched and worsening presence throughout the study. At Mudia, both testing coverage and the number of confirmed malaria cases increased substantially. The Slide Positive Rate (SPR) climbed from 4.46% to 5.76%, indicating that a growing proportion of those tested were found to be infected. More strikingly, the Annual Parasite Incidence (API) nearly doubled, rising from 0.64 to 1.50, which means that the risk of malaria in the population significantly increased in a relatively short period. These trends point to a deteriorating malaria situation and highlight the area's vulnerability to continued transmission. Shergarh, in particular, emerged as a malaria hotspot with the highest indices among all surveyed areas. Interestingly, while the number of blood smears examined at Shergarh decreased slightly, the persistently high number of positive cases kept the SPR elevated, moving from 7.03% to 7.79%. This suggests that malaria transmission in Shergarh is not only intense but also resilient, perhaps fueled by local ecological or socio-economic factors that sustain the mosquito population and facilitate human-vector contact. The high rates of infection in Shergarh may also indicate gaps in prevention measures, such as inconsistent use of insecticide-treated nets or challenges in accessing timely and effective treatment.

A closer look at the parasite species reveals a pronounced dominance of Plasmodium

falciparum in Baheri, especially within Shergarh. The preponderance of Pf is a matter of particular concern, as this species is responsible for the most severe and potentially fatal forms of malaria. The data suggest that Baheri, and Shergarh in particular, have become strongholds for Pf transmission. This pattern could reflect a combination of environmental suitability for the vector, possible drug resistance, or insufficient malaria control measures. The persistent and high levels of Pf indicate that standard interventions may not be enough, and targeted, species-specific approaches—including improved case management, enhanced vector control, and community engagement—will be essential to curb transmission and prevent severe disease.

Overall, the findings from both Nawabganj and Baheri underscore the dynamic and heterogeneous nature of malaria epidemiology in the region. While Nawabganj is experiencing an alarming rise in cases and a worrying shift towards more dangerous parasite species, Baheri's entrenched malaria burden, especially in Shergarh, highlights the need for intensified and context-specific control efforts. These results call for urgent public health action, including strengthening surveillance, adapting intervention strategies, and addressing the unique drivers of malaria transmission in each locality.

Table: Malaria Prevalence in Nawabganj and Baheri

S. No.	Locality	Collection Site	Population	Total Slides Examined	Total Positive Cases	Annual Parasite Incidence (API%)	*P. vivax* Cases	*P. falciparum* (Pf) Cases	Slide Positive Rate (SPR %)
1	**Nawabganj**	Nawabganj	1,72,932	4,561	81	0.46	81	0	1.77
2	**Baheri**	Mudia	1,68,154	2,443	109	0.64	109	0	4.46
		Shergarh	1,73,033	2,603	183	1.05	183	0	7.03

Discussion

Malaria is a disease that doesn't affect all places equally; its impact varies dramatically not only between different cities, but often even between neighbouring communities within the same city (Anon, 1996). This uneven distribution became strikingly apparent during our investigation. We concentrated our study on five key regions within Bareilly district—Nawabganj and Baheri,—and observed that malaria rates fluctuated considerably from one period to another. Some years or specific seasons saw sharp increases in cases, while others

experienced relative lulls. This confirms that malaria transmission in the area is highly unstable, echoing findings from previous research by Beaver et al. (1984) and Subhasini et al. (2002), and underscoring the need for continued vigilance and adaptable public health strategies. To gain a clearer understanding of malaria's local dynamics, we analyzed records provided by the District Malaria Office in Bareilly. We employed both active and passive surveillance methods. Notably, passive case detection—where health systems record cases as patients seek treatment—proved significantly more effective at identifying malaria cases than active surveillance or broad mass surveys, which involve proactively seeking out cases in the community. This suggests that local health facilities are a crucial front line in monitoring and responding to malaria, and that investments in strengthening these systems could yield better detection and control outcomes.

The spread of malaria is influenced by a complex interplay of biological, environmental, and social factors. However, temperature and rainfall stand out as particularly powerful drivers (Woube, 1997). In the context of Bareilly, our data showed that the number of malaria cases began to climb almost immediately after the onset of the rainy season, reaching their peak following the monsoon. This pattern is easily explained: the monsoon produces extensive standing water, which becomes ideal breeding habitat for mosquitoes, the primary vectors of malaria (Anon, 1958). This seasonal surge in vector populations directly translates into increased risk for local communities. It also highlights the importance of targeted vector control and environmental management efforts timed to precede or coincide with the rainy season, such as draining stagnant water, promoting the use of insecticide-treated bed nets, and conducting community education campaigns. When it came to measuring malaria prevalence, we found that the Slide Positivity Rate (S.P.R.) was a more reliable indicator than the Annual Parasite Index (A.P.I.) in this setting. S.P.R.—the percentage of blood slides found positive for malaria parasites—offers a more stable and accurate reflection of disease presence, particularly in years when the number of blood samples tested is low. Unlike A.P.I., which can be skewed by fluctuations in sampling rates, S.P.R. provides a clearer picture of the actual burden of malaria, allowing for more precise monitoring and intervention planning.

Another notable observation from our study was the higher incidence of malaria in peri-urban and rural areas compared to more urbanized zones. These outlying regions often present more abundant and less managed breeding sites for mosquitoes, such as stagnant ponds, irrigation ditches, and poorly drained fields. Moreover, populations in these areas may have less access to health services, fewer resources for preventive measures, and lower levels of awareness about malaria risks and control strategies. This spatial variation in malaria burden underscores the importance of tailoring interventions to the unique characteristics and needs

of each community, rather than relying on a one-size-fits-all approach. In summary, our findings reveal that malaria transmission in Bareilly district is highly unstable and influenced by a range of environmental and social factors. Surveillance methods and indicators must be chosen carefully to accurately monitor disease trends. Additionally, targeted interventions—especially in vulnerable peri-urban and rural areas—are essential for effective malaria control. Ongoing research, flexible public health responses, and community engagement will all be critical components in the ongoing effort to reduce the burden of malaria in this region.

References:

1. Anonymous (1996). Training module for medical officers of primary health centers. Part(1), 76-80

2. Beaver, P.C., Tuny, R.E. and Cupp, W.E. (1984). Malaria parasite mor-phology. Clinical Parasitology (9th Edition), 186-186.

3. Chopra, A.K. and Kumar, P. (1987). Malaria infection in and around BHEL locality of Hardwar. Him.J. Env. Zool, Vol.1, pp 118-122

4. Chatterjee, K.D. (1976). Parasitology. Chatterjee Medical Publishers, Cal-cutta

5. Chatterjee, K.D. (1980). Parasitology (Protozoology and Helminthology) in relation to clinical medicine. Twelth Edition: 1-237,32 Acharya Praful-la Chandra Road, Calcutta

6. Chatterjee Parasitology. Chatterjee Medical Publishers, Calcutta.

7. Kumar, A. (1997). Urban Malaria and its control in India. J. Parasitic Dis., 21:83-88

8. Sharma, S., Muqbil, N.A., Lal, B. and Mathur, K.K. (2002). Malaria inci-dence, slide positive rate and annual parasite incidence in some part of Jaipur. J. Exp. Zool. India., Vol. 5, No.1, pp.89-93

9. Subhasini, S., Muqbil, N.A., Lal, B. and Mathur, K.K. (2002). Malaria in-cidence, Slide positive rate and Annual parasite incidence in some part of Jaipur. J.Exp. Zool. India, 5(1): 89-93.

10. Woube, M. (1997). The geographical distribution and dramatic increase in incidences of malaria: Consequences of resettlement scheme in Gam-ber, SW Ethopia. Abst. in Second global meet on parasitic diseases. 221.