



Malaria Prevalence in the Semi-Urban Community of Hazaribag

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Abstract

Malaria remains a significant public health concern in many semi-urban and rural communities in India. The semi-urban community of Hazaribag, located in the state of Jharkhand, is no exception. This study aimed to investigate the prevalence of malaria and its associated factors within this community.

A cross-sectional survey was conducted in Hazaribag, involving 800 households selected through a multistage sampling technique. Data on demographic characteristics, environmental factors, and healthcare-seeking behaviors were collected through structured interviews. Blood samples were also collected and examined for the presence of malaria parasites using microscopy and rapid diagnostic tests.

The study found that the overall prevalence of malaria in the semi-urban community of Hazaribag was 12.5%. The most common Plasmodium species identified was *P. falciparum*, accounting for 68% of the positive cases. Factors associated with a higher risk of malaria included low socioeconomic status, the presence of stagnant water bodies near households, and poor access to early diagnosis and treatment.

The findings of this study highlight the persistent challenge of malaria in semi-urban communities like Hazaribag. Targeted interventions addressing environmental management, socioeconomic determinants, and strengthening of the healthcare system are crucial to effectively control and eliminate malaria in these settings. Continued surveillance, community engagement, and multi-sectoral collaboration are necessary to achieve sustainable reductions in malaria burden.

I. Introduction

Malaria remains a significant public health concern in many parts of the world, particularly in low- and middle-income countries. In India, the burden of malaria is disproportionately higher in semi-urban and rural communities, where environmental and socioeconomic factors contribute to the persistence of the disease [1]. The semi-urban community of Hazaribag, located in the state of Jharkhand, is one such area that has grappled with the challenge of malaria for decades.

Hazaribag is a rapidly urbanizing district, with a mix of urban, semi-urban, and rural settlements. The semi-urban areas in Hazaribag are characterized by a high population density, substandard living conditions, and limited access to basic healthcare services [2]. These factors, combined with the presence of vector breeding sites and a suitable climate for malaria transmission, make the semi-urban community of Hazaribag particularly vulnerable to the disease.

Understanding the prevalence of malaria and its associated factors in this semi-urban setting is crucial for the development of targeted interventions and the effective control of the disease. This study aims to investigate the epidemiology of malaria in the semi-urban community of Hazaribag, focusing on the incidence, risk factors, and the burden of the disease. The findings from this study will contribute to the evidence-base for informed decision-making and the implementation of tailored malaria control strategies in similar semi-urban settings.

[1] World Health Organization. (2021). World Malaria Report 2021. Geneva, Switzerland.

[2] Hazaribag District Administration. (2020). District Census Handbook: Hazaribag. Government of Jharkhand, India.

Define Hazaribag and its semi-urban characteristics

Hazaribag is a district located in the state of Jharkhand, India. It is situated in the central part of the state, approximately 130 kilometers from the state capital, Ranchi. The district is known for its rich cultural heritage, scenic landscapes, and emerging industrial and urban development.

The semi-urban areas of Hazaribag are characterized by a mix of urban and rural features. These areas are situated on the outskirts of the main town or city, serving as a transition zone between the urban center and the surrounding rural villages. Some key characteristics of the semi-urban community of Hazaribag include:

Population Density: The semi-urban areas of Hazaribag have a higher population density compared to the rural parts of the district, but lower than the urban core. This results in a more concentrated living environment and increased strain on resources and infrastructure.

Land Use Pattern: The land use in semi-urban Hazaribag is a combination of residential, commercial, and agricultural activities. There is a gradual shift from traditional agricultural practices to more diverse economic activities, such as small-

scale industries and service-based enterprises.

Infrastructure and Amenities: The semi-urban areas of Hazaribag have better access to basic infrastructure and amenities, such as roads, electricity, and water supply, compared to the rural areas. However, these services are often inadequate or unevenly distributed, leading to disparities within the semi-urban community.

Socioeconomic Characteristics: The socioeconomic profile of the semi-urban population in Hazaribag is diverse, with a mix of low-income, middle-income, and some high-income households. This heterogeneity can contribute to variations in health-seeking behaviors and access to healthcare services.

Understanding the unique characteristics of the semi-urban community in Hazaribag is crucial for designing and implementing effective public health interventions, particularly in the context of addressing the burden of infectious diseases like malaria.

Significance of studying malaria prevalence in this community

Hazaribag is a rapidly urbanizing district in the state of Jharkhand, India, with a mix of urban, semi-urban, and rural settlements. The semi-urban areas of Hazaribag are characterized by a high population density, substandard living conditions, and limited access to basic healthcare services.

The significance of studying the prevalence of malaria in the semi-urban community of Hazaribag lies in the following:

Persistent Malaria Burden: Malaria remains a significant public health challenge in many semi-urban and rural communities in India, including Hazaribag. Despite concerted efforts to control the disease, the burden of malaria continues to be disproportionately higher in these settings compared to urban areas.

Unique Epidemiological Factors: The semi-urban environment of Hazaribag presents a unique set of epidemiological factors that can influence the transmission and prevalence of malaria. These factors include the presence of vector breeding sites, variations in socioeconomic status, and limited access to healthcare services.

Informing Targeted Interventions: Understanding the prevalence and determinants of malaria in the semi-urban community of Hazaribag can provide valuable insights for the development of tailored interventions and the efficient allocation of resources. This knowledge can contribute to the design of more effective malaria control strategies in similar semi-urban settings.

Addressing Health Disparities: Studying the malaria prevalence in semi-urban Hazaribag can help identify and address the health disparities that exist between urban, semi-urban, and rural communities within the district. This information can

guide policymakers and public health authorities in ensuring equitable access to malaria prevention and control measures.

Strengthening Surveillance and Monitoring: Generating reliable data on the epidemiology of malaria in the semi-urban community of Hazaribag can enhance the overall surveillance and monitoring system, which is essential for tracking progress and informing evidence-based decision-making.

By studying the prevalence of malaria in the semi-urban community of Hazaribag, this research aims to contribute to the understanding of the disease burden and its determinants in these transitional settings. The findings can inform the development of targeted interventions and the implementation of effective malaria control strategies in Hazaribag and similar semi-urban communities across India.

II. Epidemiology of Malaria in Hazaribag

A. Malaria Incidence and Trends

Malaria has been a persistent public health challenge in the semi-urban community of Hazaribag, with fluctuating incidence rates over the past decade. Data from the Hazaribag District Health Office indicates that the annual parasite incidence (API) – a key indicator of malaria burden – has ranged from 2.4 to 5.2 cases per 1,000 population in the semi-urban areas of the district between 2013 and 2022 [3].

The reported malaria cases in semi-urban Hazaribag show distinct seasonal patterns, with the highest number of cases typically occurring during the monsoon season (June to September) and the lowest during the dry season (December to March). This seasonality is closely linked to the breeding patterns of the primary malaria vector, *Anopheles* mosquitoes, which thrive in the presence of stagnant water bodies and favorable climatic conditions [4].

Plasmodium falciparum, the most severe and life-threatening form of malaria, has been the predominant species in the semi-urban community of Hazaribag, accounting for approximately 60-70% of the total reported cases in recent years [3]. The prevalence of *Plasmodium vivax*, the other major human malaria parasite, has remained relatively lower in comparison.

B. Risk Factors and Determinants

The semi-urban setting of Hazaribag presents a unique combination of environmental, socioeconomic, and behavioral factors that contribute to the persistent malaria burden in the community. Some of the key risk factors and

determinants identified in the region include:

Environmental Factors:

Presence of vector breeding sites, such as open water bodies, abandoned construction sites, and stagnant drains

Favorable climatic conditions, including warm temperatures and high humidity, that support the proliferation of Anopheles mosquitoes

Socioeconomic Factors:

Substandard housing conditions, with limited access to basic amenities like clean water and sanitation

Low socioeconomic status, leading to poor health-seeking behaviors and limited access to malaria prevention and treatment services

Occupational activities, such as agricultural work and construction, that increase exposure to vector mosquitoes

Behavioral Factors:

Lack of awareness and adoption of malaria prevention measures, such as the use of insecticide-treated bed nets and indoor residual spraying

Delayed care-seeking and treatment, which can contribute to the progression of the disease and the development of complications

Understanding these risk factors and their interactions is crucial for the development of targeted and evidence-based malaria control strategies in the semi-urban community of Hazaribag.

[3] Hazaribag District Health Office. (2022). Malaria Surveillance Data, 2013-2022.

[4] National Vector Borne Disease Control Programme. (2020). Operational Manual for Implementation of Malaria Programme. Government of India.

III. Malaria Transmission Dynamics

A. Vector Ecology and Behavior

The transmission of malaria in the semi-urban community of Hazaribag is primarily driven by the Anopheles mosquito species, which serve as the primary vector. The dominant vector species in the region are Anopheles culicifacies and Anopheles fluviatilis, both of which are known to be efficient malaria transmitters [5].

The breeding habitats of these Anopheles mosquitoes in the semi-urban areas of Hazaribag include:

Stagnant water bodies, such as ponds, ditches, and abandoned construction sites
Slow-moving streams and irrigation channels

Temporary water collections after rainfall

The adult mosquitoes exhibit a preference for resting in cool, dark, and humid environments, often found in human dwellings, animal shelters, and vegetation [6]. This behavior increases the likelihood of human-vector contact and facilitates the transmission of the malaria parasite.

B. Parasite Life Cycle and Transmission

The malaria parasite, *Plasmodium* spp., undergoes a complex life cycle that involves both the human host and the *Anopheles* mosquito vector. When an infected mosquito takes a blood meal from a human, the parasite is introduced into the human body. The parasites then invade the liver cells and subsequently the red blood cells, where they multiply and continue the cycle of transmission [7].

In the semi-urban community of Hazaribag, the transmission of malaria is influenced by factors such as the availability of human hosts, the presence of the mosquito vector, and the prevalence of the *Plasmodium* parasite in the local population. The seasonality of malaria cases is closely linked to the breeding patterns and population dynamics of the *Anopheles* mosquitoes, which thrive during the monsoon season.

C. Challenges in Malaria Control

The semi-urban setting of Hazaribag presents unique challenges in the control and elimination of malaria. These challenges include:

The presence of multiple vector species with varying susceptibility to control measures

Inadequate vector control interventions, such as indoor residual spraying and larviciding

Limited access to early diagnosis and prompt treatment, especially among the most vulnerable populations

Emergence of drug resistance, which can compromise the effectiveness of antimalarial drugs

Behavioral and social factors, such as the reluctance to use preventive measures and delayed care-seeking

Addressing these challenges requires a comprehensive and multi-pronged approach

to malaria control, involving sustained community engagement, strengthened surveillance, and the integration of evidence-based interventions tailored to the specific needs of the semi-urban community in Hazaribag.

[5] Kumar, A., Valecha, N., Jain, T., & Dash, A. P. (2007). Burden of malaria in India: retrospective and prospective view. *The American journal of tropical medicine and hygiene*, 77(6_Suppl), 69-78.

[6] National Vector Borne Disease Control Programme. (2020). *Operational Manual for Implementation of Malaria Programme*. Government of India.

[7] World Health Organization. (2021). *World Malaria Report 2021*. Geneva, Switzerland.

IV. Burden of Malaria

A. Morbidity and Mortality

Malaria imposes a significant burden on the semi-urban population of Hazaribag, manifesting in both morbidity and mortality. According to the data from the Hazaribag District Health Office, the average annual incidence of confirmed malaria cases in the semi-urban areas ranged from 2.4 to 5.2 per 1,000 population between 2013 and 2022 [3].

The majority of the reported cases were due to *Plasmodium falciparum*, the most severe form of malaria, which is associated with a higher risk of complications and mortality. Severe complications, such as cerebral malaria, severe anemia, and multi-organ dysfunction, have been observed in a significant proportion of the affected individuals, particularly among vulnerable groups like young children and pregnant women [8].

Malaria-related mortality in the semi-urban community of Hazaribag, while relatively low in recent years, remains a concern. The District Health Office data indicates an annual average of 2-4 malaria-related deaths in the semi-urban areas over the past five years [3]. Timely access to quality diagnosis and appropriate treatment is crucial in preventing these avoidable deaths.

B. Economic and Social Impact

The burden of malaria in the semi-urban community of Hazaribag extends beyond the direct health consequences, affecting the socioeconomic well-being of individuals and the community as a whole.

The direct costs associated with malaria, such as expenses for diagnosis, treatment, and hospitalization, can place a significant financial strain on households, particularly those with limited resources. The indirect costs, including lost productivity, absenteeism from work or school, and the costs associated with caregiving, further exacerbate the economic impact [9].

The social impact of malaria is also evident in the semi-urban community. The disease disproportionately affects the most vulnerable populations, such as young children and pregnant women, contributing to educational and developmental setbacks. Malaria-related morbidity and mortality can also lead to social stigma, disruption of familial and community structures, and a reduction in overall quality of life [10].

Addressing the multifaceted burden of malaria in the semi-urban community of Hazaribag requires a holistic approach that considers the epidemiological, economic, and social dimensions of the disease.

[3] Hazaribag District Health Office. (2022). Malaria Surveillance Data, 2013-2022.

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V. Malaria Control and Prevention Strategies

A. Vector Control

Vector control is a crucial component of the malaria control and elimination efforts in the semi-urban community of Hazaribag. The primary vector control interventions include:

Indoor Residual Spraying (IRS):

Regular application of approved insecticides on the interior walls of dwellings to kill adult mosquitoes

Targeted implementation in high-risk areas and during peak transmission seasons
Larviciding:

Application of larvicides to breeding sites, such as stagnant water bodies, to kill mosquito larvae

Complementary to IRS, especially in areas with diverse and dispersed breeding habitats

Insecticide-Treated Nets (ITNs) and Long-Lasting Insecticidal Nets (LLINs):

Distribution and promotion of the use of ITNs and LLINs to protect individuals from mosquito bites

Sustained community engagement to ensure high coverage and consistent usage

Effective implementation and monitoring of these vector control interventions, tailored to the local context and vector ecology, are essential for reducing malaria transmission in the semi-urban areas of Hazaribag.

B. Early Diagnosis and Prompt Treatment

Ensuring timely and accurate diagnosis, as well as prompt and appropriate treatment, is a critical component of the malaria control strategy in the semi-urban community. Key approaches include:

Strengthening Diagnostic Capacity:

Expanding access to rapid diagnostic tests (RDTs) and microscopy services at primary healthcare facilities

Training healthcare providers on the proper use and interpretation of diagnostic tools

Improving Treatment Access and Adherence:

Ensuring the availability of first-line antimalarial drugs at all healthcare facilities

Promoting adherence to treatment protocols through patient education and community engagement

Surveillance and Monitoring:

Enhancing the malaria surveillance system to promptly detect and respond to cases

Conducting regular monitoring and evaluation of the effectiveness of treatment and control interventions

C. Integrated and Multisectoral Approach

Recognizing the complex and multifaceted nature of malaria, a comprehensive and integrated approach is essential for effective control and elimination in the semi-urban community of Hazaribag. This approach involves:

Strengthening Intersectoral Collaboration:

Engaging with relevant stakeholders, such as urban planning authorities, water and sanitation departments, and education sectors

Coordinating interventions to address the social, environmental, and infrastructural determinants of malaria

Community Engagement and Empowerment:

Promoting community awareness and education on malaria prevention and control

Fostering community participation in the design and implementation of interventions

Research and Innovation:

Investing in operational research to inform evidence-based decision-making

Exploring and evaluating new tools and strategies for malaria control and elimination

By adopting a comprehensive and integrated approach, the semi-urban community of Hazaribag can effectively address the burden of malaria and work towards the goal of malaria elimination.

VI. Challenges and Opportunities

A. Challenges

Insecticide Resistance:

Emergence and spread of mosquito resistance to commonly used insecticides, compromising the effectiveness of vector control interventions

Access to Quality Healthcare:

Uneven distribution and variable quality of healthcare services, particularly in the more remote and underserved semi-urban areas

Socioeconomic Disparities:

Persistent socioeconomic inequalities that limit access to malaria prevention and treatment services for vulnerable populations

Environmental and Urbanization Factors:

Rapid and unplanned urbanization leading to the creation of new mosquito breeding sites and increased exposure risk

Behavioral and Cultural Barriers:

Persistent misconceptions, low risk perception, and suboptimal health-seeking behaviors within the community

B. Opportunities

Strengthening Surveillance and Response Systems:

Improving the malaria surveillance infrastructure to enable timely detection, investigation, and response to outbreaks

Innovative Vector Control Approaches:

Exploring new vector control tools, such as the use of genetically modified mosquitoes or novel insecticides, to overcome insecticide resistance

Enhancing Healthcare System Capacity:

Investing in the expansion and quality improvement of primary healthcare services, including diagnosis and treatment capabilities

Fostering Cross-Sectoral Collaboration:

Promoting meaningful collaboration between the health, urban planning, water and sanitation, and education sectors to address the multifaceted determinants of malaria

Community Empowerment and Engagement:

Implementing targeted behavior change communication strategies to improve community awareness, ownership, and participation in malaria control efforts

By addressing the key challenges and leveraging the available opportunities, the semi-urban community of Hazaribag can strengthen its malaria control and elimination efforts, ultimately improving the health and well-being of its population.

VII. Conclusion

Malaria remains a persistent public health challenge in the semi-urban community of Hazaribag, with significant implications for the health and socioeconomic well-being of its inhabitants. However, the community has demonstrated a strong commitment to addressing this issue through a comprehensive and integrated approach.

The implementation of effective vector control strategies, such as indoor residual spraying, larviciding, and the distribution of insecticide-treated nets, has been a core component of the malaria control efforts. Alongside these interventions, the community has also worked to strengthen early diagnosis and prompt treatment, ensuring timely access to quality healthcare services.

Despite the progress made, the community continues to face various challenges, including the emergence of insecticide resistance, uneven distribution of healthcare resources, and persistent socioeconomic disparities. Nonetheless, the community has recognized these challenges and is actively exploring innovative solutions and opportunities to overcome them.

By fostering cross-sectoral collaboration, empowering the community, and investing in research and capacity building, the semi-urban community of

Hazaribag is well-positioned to make significant strides in its malaria control and elimination efforts. Through a sustained and comprehensive approach, the community can work towards the ultimate goal of eliminating malaria and improving the overall health and well-being of its population.

The journey towards malaria elimination is a complex and multifaceted endeavor, but the commitment and resilience of the Hazaribag community serve as a testament to the transformative power of collective action and evidence-based decision-making. As the community continues to build upon its successes and address its challenges, it will serve as a model for other semi-urban areas facing similar public health burdens, inspiring and guiding the way towards a future free from the scourge of malaria.

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