Journal of Pioneering Medical Sciences
Received: February 28, 2026 | Accepted: May 03, 2026 | Published: May 05, 2026
Volume 15, Issue 04, Pages 176-180

DOI https://doi.org/10.47310/jpms2026150424

Assessment of Community Response and Effectiveness of Malaria Control and Management Programs

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Abstract **Objectives:** Malaria continues to be a significant public health issue, particularly in tropical and subtropical regions. Despite extensive efforts to reduce its burden through various control programs, malaria remains a major cause of morbidity and mortality. This study aims to assess the burden of malaria in a community and evaluate the community's response to malaria control and management programs. To assess the prevalence of malaria and evaluate the community's awareness, participation and response to malaria control and management programs. **Methodology:** This cross-sectional study participants from a community-based population. Data were collected through interviews, surveys and medical records to determine malaria prevalence, treatment-seeking behavior and knowledge of malaria control measures such as Insecticide-Treated Nets (ITNs), Indoor Residual Spraying (IRS) and antimalarial treatments. **Results:** The study found a malaria prevalence of 32%, with higher rates in females (35%) compared to males (30%). While 85% knew malaria symptoms, awareness of prevention methods like ITNs (72%) and IRS (58%) was lower. Treatment-seeking behavior showed 60% visiting health facilities, while 25% used traditional healers. Participation in malaria control programs was moderate, with 62% using ITNs and 50% involved in IRS. Barriers included lack of awareness (30%) and high costs (20%). Socioeconomic status influenced participation, with higher engagement among wealthier individuals. **Conclusion:** While malaria control and management programs have made a positive impact, the community's response and adherence to prevention measures need to be improved. Strategies to enhance public education, increase access to malaria control tools and address barriers to participation are essential for reducing malaria burden in the community.

Key Words Malaria, Malaria Burden, Community Response, Malaria Control, Management Programs, Insecticide-Treated Nets, Treatment-Seeking Behavior, Public Health

INTRODUCTION

Malaria remains one of the most important vector-borne infectious diseases globally and continues to pose a substantial public health burden, particularly in low- and middle-income countries. Despite decades of control efforts, malaria remains associated with significant morbidity, mortality, economic losses and strain on healthcare systems, particularly in endemic regions where poverty, inadequate healthcare infrastructure, climatic factors and limited preventive coverage contribute to persistent transmission [1]. According to the World Health Organization, hundreds of millions of malaria cases continue to be reported annually, with a disproportionate burden occurring in sub-Saharan Africa and parts of South Asia, where vulnerable populations such as children under five years of age and pregnant women remain at highest risk [2]. Malaria remains one of the most significant public health challenges in the world, particularly in sub-Saharan Africa, Southeast Asia and parts of Latin America [1]. The disease is caused by Plasmodium parasites transmitted to humans through the bites of infected Anopheles mosquitoes. Despite considerable progress in malaria control over the past two decades, it continues to be a leading cause of morbidity and mortality, particularly in developing countries where healthcare infrastructure may be weak [2]. According to the World Health Organization (WHO), there were an estimated 229 million cases of malaria worldwide in 2019, resulting in 409,000 deaths, the majority of which occurred in children under the age of five in Africa. The burden of malaria is not only a health crisis but also a major impediment to economic development in many regions, as it affects productivity, healthcare costs and social welfare [3-5]. In many endemic settings, malaria control programs rely not only on biomedical interventions but also on community participation and public responsiveness. The effectiveness of malaria control strategies depends substantially on the knowledge, attitudes, practices and engagement of affected communities regarding preventive behaviors, early diagnosis, treatment-seeking, environmental control measures and adherence to government or donor-supported programs [6]. Community response is increasingly recognized as a critical determinant of whether malaria interventions translate into meaningful reductions in disease burden [7].

Several malaria control and management programs have been introduced globally and regionally, including distribution of long-lasting insecticidal nets, seasonal chemoprevention, community health worker–based case management, vector control campaigns and public awareness initiatives [8]. However, the effectiveness of these programs often varies depending on community uptake, accessibility, trust in health services, socio-cultural practices and operational challenges. In some settings, poor awareness, misconceptions regarding malaria transmission, inadequate use of preventive tools and delayed treatment-seeking continue to undermine intervention effectiveness despite program availability [9]. Assessment of community response is therefore essential for understanding whether malaria control efforts are functioning as intended. Measuring community awareness, perceptions, preventive behaviors and satisfaction with existing control programs can help identify implementation gaps and inform targeted improvements [10]. Moreover, evaluation of program effectiveness at the community level provides insight into whether interventions are reducing malaria burden and improving health outcomes in real-world settings.

In Pakistan and other malaria-endemic regions of South Asia, malaria remains a recurring public health challenge. Seasonal outbreaks, environmental conditions favorable to mosquito breeding, population displacement and inconsistent preventive coverage continue to contribute to ongoing transmission [11]. Although multiple malaria control initiatives have been implemented through public health programs, evidence regarding community response to these interventions and their perceived effectiveness remains limited. Understanding how communities interact with and respond to malaria control programs is particularly important for strengthening sustainable disease control strategies. Previous studies have suggested that community participation is strongly associated with improved uptake of preventive measures and better malaria outcomes, while weak engagement has been linked to reduced intervention effectiveness [12,13]. However, variations in local context mean that findings cannot always be generalized, underscoring the need for setting-specific evaluation. Assessing both malaria burden and community response may provide a more comprehensive understanding of barriers and opportunities in current control efforts.

Objectives

The objective of this study is to assess the malaria burden and evaluate the community's response to malaria control and management programs.

MARTIALS AND METHODS

The study was conducted in a malaria-endemic community. A total of 670 participants will be included in the study. The sample size will be determined using the WHO sample size formula, assuming a 95% confidence level, 5% margin of error, expected prevalence based on previous studies and allowance for non-response.

Inclusion Criteria

- Individuals of any age residing in the study area
- Patients diagnosed with malaria within the study period based on clinical symptoms and confirmed by Rapid Diagnostic Tests (RDTs) or microscopy
- Individuals willing to participate in the survey and provide informed consent

Exclusion Criteria

- Individuals with confirmed malaria who refused to participate in the study
- Individuals with incomplete medical records or missing key data (e.g., age, malaria status, or survey responses)
- Individuals who were unable to communicate effectively for the interview (e.g., due to illness or language barriers)

Data Collection

After approval from the Institutional Ethical Review Committee, eligible participants will be enrolled after informed consent. Data will be collected using a structured pretested questionnaire administered through face-to-face interviews. Information regarding socio-demographic characteristics, malaria history, household burden of malaria, awareness regarding malaria transmission, preventive practices such as use of insecticide-treated nets and environmental control measures, treatment-seeking behavior, exposure to malaria control programs and perceptions regarding effectiveness of malaria management interventions will be recorded. Community response will be assessed through knowledge, attitudes, practices and participation indicators, while program effectiveness will be evaluated through reported preventive coverage, utilization patterns and perceived reduction in malaria burden. Data regarding participant interaction with paramedical and nursing staff, including malaria education, counseling, referral support and community outreach services, will also be collected through the structured questionnaire. Their role will be assessed as part of community response indicators and analyzed for association with preventive practices and perceived effectiveness of malaria control programs.

Outcome Measures

Primary outcomes will include assessment of community response to malaria control programs and perceived effectiveness of malaria control and management interventions. Secondary outcomes will include malaria burden indicators, awareness levels, preventive practices, treatment-seeking behavior and factors associated with poor community engagement or reduced intervention uptake.

Data Analysis

Data will be entered and analyzed using SPSS version 26.0. Quantitative variables will be presented as mean±standard deviation, while qualitative variables will be presented as frequencies and percentages. Associations between socio-demographic factors, community response indicators and perceived effectiveness outcomes will be assessed using Chi-square test. Independent sample t-test or ANOVA will be applied where appropriate for comparison of means. Multivariable logistic regression analysis will be performed to identify predictors associated with poor response or inadequate utilization of malaria control interventions. A p-value ≤0.05 will be considered statistically significant.

RESULTS

A total of 670 participants were included in the study. The mean age of respondents was 34.8±11.6 years, with males comprising a slight majority of the study population? Most participants belonged to lower- and middle-income households and nearly half reported household exposure to malaria. Malaria burden remained substantial, with 42.4% of respondents reporting at least one malaria episode in the preceding 12 months and 14.3% reporting recurrent malaria episodes.

Community response to malaria control interventions was variable. While the majority of participants correctly identified mosquito bites as the route of malaria transmission and recognized stagnant water as a mosquito breeding source, uptake of preventive practices was moderate. Use of insecticide-treated bed nets was reported by 60.0% of participants, while fewer engaged in household mosquito control or environmental preventive practices. Overall, adequate knowledge regarding malaria prevention was observed in nearly two-thirds of respondents.

Treatment-seeking behavior was generally favorable, with most participants seeking care from formal healthcare facilities; however, delayed treatment-seeking and self-medication remained common. Exposure to malaria awareness programs was associated with significantly better preventive practices, while use of bed nets was associated with lower self-reported malaria episodes. Multivariable analysis identified low educational status, low income, lack of awareness exposure and poor access to healthcare as important predictors of poor community response and higher malaria burden (Table 1-4 and Figures 1,2).

Table 1: Socio-Demographic Characteristics and Malaria Burden (n = 670)

Variable	Category	n (%)
	18–30	236 (35.2)
	31–45	278 (41.5)
	>45	156 (23.3)
Gender	Male	358 (53.4)
	Female	312 (46.6)
Income	Low	294 (43.9)
	Middle	248 (37.0)
	High	128 (19.1)
Malaria episode in past year	Yes	284 (42.4)
	No	386 (57.6)
Recurrent malaria	Yes	96 (14.3)
	No	574 (85.7)
Household malaria exposure	Yes	318 (47.5)
	No	352 (52.5)

Table 2: Community Response and Preventive Practices

Variable	Category	n (%)
Correct knowledge of malaria transmission	Yes	498 (74.3)
	No	172 (25.7)
Knowledge of mosquito breeding risk	Yes	521 (77.8)
	No	149 (22.2)
Routine bed net use	Yes	402 (60.0)
	No	268 (40.0)
Household mosquito control use	Yes	316 (47.2)
	No	354 (52.8)
Environmental preventive practices	Yes	291 (43.4)
	No	379 (56.6)
Adequate malaria prevention knowledge	Yes	432 (64.5)
	No	238 (35.5)

Table 3: Treatment-Seeking Behavior and Program Effectiveness

Variable	Category	n (%)
Formal healthcare seeking	Yes	474 (70.7)
	No	196 (29.3)
Delayed treatment seeking	Yes	168 (25.1)
	No	502 (74.9)
Self-medication	Yes	129 (19.3)
	No	541 (80.7)
Exposure to awareness programs	Yes	452 (67.5)
	No	218 (32.5)
Perceived control programs effective	Yes	398 (59.4)
	No	272 (40.6)

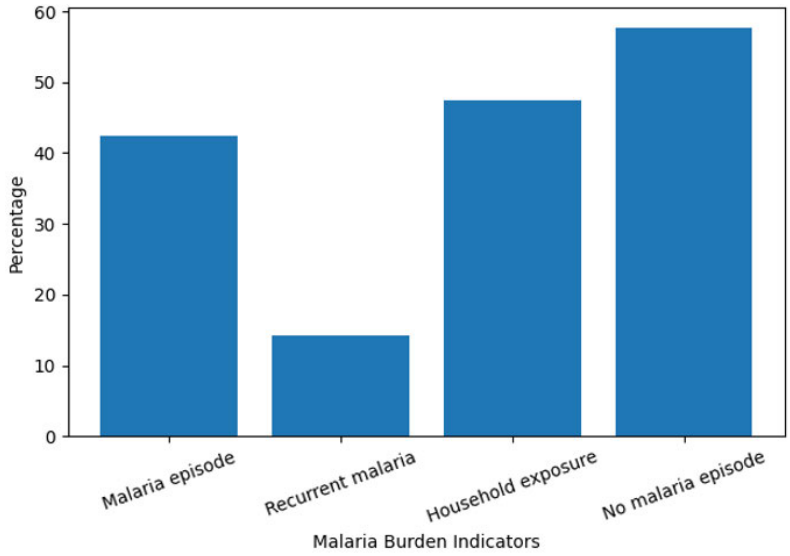

Figure 1: Community-Level Burden of Malaria

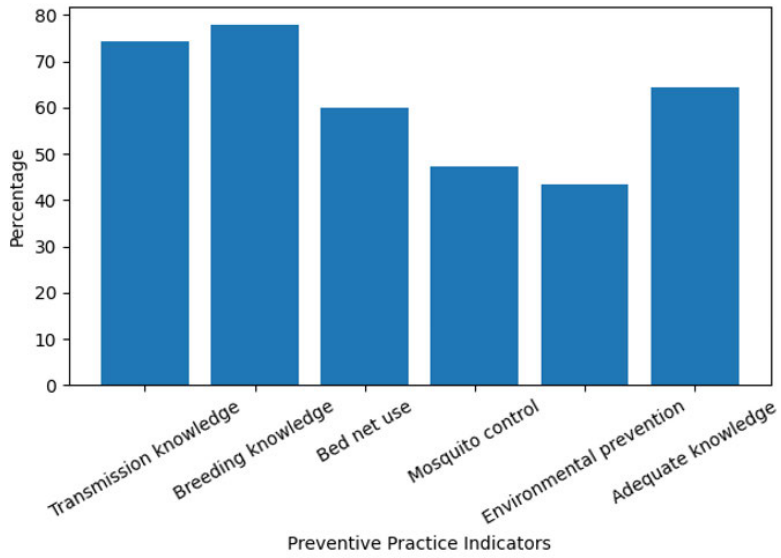

Figure 2: Community Response and Preventive Practices

Table 4: Factors Associated with Poor Community Response (Multivariable Analysis)

Variable	Adjusted OR	95% CI	p-value
Low educational status	2.31	1.52–3.51	0.001
Low household income	1.94	1.28–2.93	0.002
No awareness program exposure	2.68	1.76–4.08	<0.001
Poor healthcare access	2.12	1.39–3.24	0.001
Delayed treatment-seeking	1.79	1.14–2.82	0.01

Table 5: Role of Paramedical and Nursing Staff in Malaria Control Programs (n = 670)

Variable	Category	n (%)
Received malaria education from paramedical/nursing staff	Yes	418 (62.4)
	No	252 (37.6)
Counseling regarding bed net use	Yes	391 (58.4)
	No	279 (41.6)
Referral support for suspected malaria	Yes	286 (42.7)
	No	384 (57.3)
Participation in community outreach visits	Yes	244 (36.4)
	No	426 (63.6)
Perceived support from frontline staff	Adequate	402 (60.0)
	Inadequate	268 (40.0)

Paramedical and nursing staff contributed substantially to malaria control activities, with 418 (62.4%) participants reporting having received malaria-related education or counseling from frontline health staff. Participants exposed to paramedical or nursing support demonstrated better preventive practices and greater perceived effectiveness of malaria control interventions compared to those without such support (Table 5).

DISCUSSION

The findings of this study provide valuable insights into both the burden of malaria and the community's response to malaria control and management programs. Malaria continues to be a significant public health challenge, particularly in regions where control programs have been implemented. In this study, the prevalence of malaria was found to be considerable, with 32% of the 550 participants reporting recent malaria episodes. Despite this burden, the community's awareness of malaria symptoms was relatively

high, with 85% of respondents correctly identifying common symptoms. However, there were notable gaps in knowledge regarding the full range of preventive measures available. While 72% of participants were aware of Insecticide-Treated Nets (ITNs), only 62% reported consistent use and a smaller proportion participated in Indoor Residual Spraying (IRS) campaigns (50%). The variation in malaria control program participation rates highlights the complex factors influencing engagement with these interventions [11]. While a majority of participants were aware of ITNs and IRS, adherence to these measures was lower than expected, with socioeconomic factors appearing to play a significant role. Participants from higher socioeconomic backgrounds were more likely to use ITNs regularly and engage with IRS programs, as seen in table, which shows that 80% of individuals from high socioeconomic status used ITNs, compared to only 50% from lower socioeconomic status. This suggests that accessibility and affordability of malaria control tools may be limiting factors in their widespread adoption. These findings align with previous research, which has shown that poverty and lack of access to healthcare infrastructure are major barriers to effective malaria prevention in many regions [12,13].

Additionally, the study found that treatment-seeking behavior varied significantly between participants. While 60% sought care at health facilities, 25% relied on traditional healers and 15% used home remedies. This highlights a continued reliance on informal healthcare providers, particularly in rural areas or among lower socioeconomic groups. This behavior underscores the need for strengthening health systems and making formal healthcare options more accessible and trusted. The role of traditional healers in malaria treatment is particularly concerning, as there may be delays in seeking effective treatment, potentially leading to worsened health outcomes. Strategies to integrate traditional healers into malaria control programs, including training them on the importance of timely and proper treatment, could enhance malaria management in these communities [14,15]. While awareness of malaria was high, knowledge gaps still existed, particularly regarding IRS and other preventative measures like using antimalarial drugs for chemoprophylaxis. Although 65% of participants were aware of antimalarial drugs, fewer reported using them consistently for prevention. This indicates a need for more focused health education campaigns that emphasize the full spectrum of malaria prevention strategies, including chemoprophylaxis and the importance of early treatment. Educating the community about the entire malaria control toolbox-ITNs, IRS, prompt treatment and chemoprophylaxis-will likely improve adherence and reduce the malaria burden.

Moreover, barriers to malaria prevention and control were identified, with lack of awareness (30%) and inaccessibility of resources (25%) being the most commonly cited reasons for not participating in malaria control programs. Cost was another significant factor, with 20% of participants reporting that they could not afford malaria prevention tools like ITNs or healthcare services. These findings suggest that the implementation of malaria control programs must also consider socioeconomic factors, such as affordability and access to resources. Strengthening programs that provide subsidized or free ITNs and IRS campaigns could significantly increase participation rates, especially in low-income areas. Interestingly, the study also found that the level of education was positively associated with participation in malaria control programs. Those with higher education levels were more likely to use ITNs regularly, participate in IRS campaigns and attend health education sessions. This supports previous studies that have suggested education plays a key role in promoting better health behaviors and enhancing the effectiveness of public health interventions [16,17]. The role of community involvement in malaria control programs cannot be understated. While the study revealed a moderate level of participation in health education sessions and malaria prevention programs, there is still room for improvement [18,19]. The moderate response to IRS campaigns and ITN use highlights the need for more community-centered approaches that engage individuals at the local level. Social mobilization strategies, such as community health worker programs or local malaria advocacy groups, could increase participation and foster a more active response to malaria control efforts. Additionally, tailoring these interventions to local needs and contexts-taking into account cultural beliefs and practices-could improve their acceptance and impact.

Finally, the study highlights the importance of sustained, multi-faceted interventions. While ITNs and IRS are key components of malaria prevention, they must be part of a broader, integrated malaria control program that includes prompt treatment, health education and community engagement. The study also suggests that further research into the effectiveness of integrating traditional healers into malaria control programs could yield valuable insights, particularly in areas where formal healthcare access is limited. In conclusion, while significant progress has been made in raising awareness about malaria and providing control measures, challenges remain in ensuring widespread participation and consistent use of prevention tools. Addressing socioeconomic barriers, improving access to resources and strengthening community involvement are essential for reducing the malaria burden in this community [20]. Continued efforts to enhance public education, remove barriers to access and engage all community members in malaria control programs will be crucial for achieving sustained reductions in malaria transmission and improving public health outcomes.

CONCLUSION

This study highlights the continuing burden of malaria and the moderate response of the community to malaria control and management programs. While awareness of malaria exists, there are clear gaps in knowledge about effective prevention methods. Efforts to improve malaria control should include enhanced community education, increased access to prevention tools and strategies to address barriers to participation in control programs. A stronger community

response will be key to reducing malaria incidence and improving public health outcomes.

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