

Community-based Promotive and Preventive Approaches in Malaria Control: Empirical Evidence from an Endemic Region in South Papua, Indonesia

Muhamad Safwan Karepesina^{1*}, Muhammad Syafar¹, Suriah Suriah¹,
Andi Zulkifli², Shanti Riskiyani¹

¹Department of Health Promotion and Behavioral Sciences, Faculty of Public Health, Hasanuddin University, Makassar, South Sulawesi, Indonesia, ²Department of Epidemiology, Hasanuddin University, Makassar, South Sulawesi, Indonesia. *Corresponding Author's Email: safwankarepesina85@gmail.com

Abstract

Malaria remains a major public health challenge in South Papua, Indonesia, particularly in endemic areas with persistent transmission and severe geographical constraints. This study aimed to explore the implementation of community-based promotive and preventive malaria control programs in the working area of Mindiptana Public Health Center, Boven Digoel Regency. A qualitative phenomenological design was employed to understand the experiences and perceptions of stakeholders involved in malaria control. A total of 36 informants participated in the study, including one policymaker, four healthcare workers, twenty-six malaria cadres and five community leaders. Data were collected through in-depth interviews, focus group discussions, observations, document reviews and photovoice techniques and were analyzed using thematic analysis supported by NVivo software. Four major themes emerged: community awareness of malaria, environmental risk conditions, the role of malaria cadres and local leaders and barriers to program implementation. The findings showed that health education, distribution of insecticide-treated bed nets and the active involvement of malaria cadres and local leaders contributed positively to malaria prevention efforts. However, preventive practices such as consistent bed-net use remained inconsistent due to sociocultural beliefs, nighttime outdoor activities, geographical barriers, limited resources and logistical constraints. socioeconomically disadvantaged households and geographically isolated riverine villages were disproportionately affected by delayed care and persistent transmission. Strengthening malaria cadres, continuous culturally adapted health promotion, local breeding site management, improved logistical support and community empowerment are recommended to enhance sustainable malaria elimination in high-endemic remote settings.

Keywords: Community-based Intervention, Health Promotion, Malaria, Malaria Control, Prevention, South Papua.

Introduction

Malaria remains one of the most significant public health challenges globally (1), particularly in low and middle-income countries located in tropical regions. The disease is caused by *Plasmodium* parasites and transmitted through bites of infected female *Anopheles* mosquitoes (2). Despite substantial progress in malaria prevention and control over the last two decades, malaria continues to contribute significantly to morbidity and mortality, especially in endemic regions characterized by environmental vulnerabilities and limited healthcare infrastructure (3). Globally, an estimated 282 million malaria cases and approximately 610,000 malaria-related deaths were reported in 2024 across 80 endemic countries (4). Beyond its health consequences, malaria imposes substantial socioeconomic

burdens, including reduced agricultural and labor productivity, high household healthcare expenditures, educational disruptions among children and diminished overall quality of life (5). Indonesia has demonstrated notable progress toward national malaria elimination, with substantial reductions in malaria transmission across many administrative areas. However, these achievements remain geographically unequal across the archipelago, with eastern Indonesia, particularly Papua, continuing to contribute disproportionately to the national malaria burden (6). Within South Papua Province, particularly in Boven Digoel Regency, malaria transmission remains a persistent public health challenge. Papua continues to experience a disproportionately high malaria burden compared with other

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regions of Indonesia and strengthening surveillance systems remains essential to identify transmission patterns, guide interventions and support malaria elimination efforts (7). These challenges highlight that conventional malaria control approaches may require further adaptation to address the geographical, ecological and health system constraints in remote endemic settings (8). Such findings suggest that conventional interventions may not sufficiently address local determinants of malaria transmission.

Previous empirical studies in Indonesia have demonstrated that environmental conditions and individual preventive behaviors play important roles in malaria transmission. Factors such as proximity to mosquito breeding sites, housing conditions and personal protection practices have been identified as important determinants influencing malaria risk in endemic areas (9). Prior research has established that ecological conditions such as stagnant water bodies, rainfall variability, vegetation characteristics and proximity to malaria vector habitats significantly influence malaria transmission dynamics (10). Climate variability and environmental changes have also been recognized as important determinants affecting mosquito distribution and malaria transmission patterns, particularly in endemic regions (11). Additionally, quasi-experimental evaluations have indicated that community-based educational interventions and volunteer network activities can improve short-term health literacy and self-reported bed-net usage (12).

However, these previous studies present key limitations: they predominantly focus on quantitative epidemiological metrics, vector species distribution, or technical program outcomes while offering limited depth regarding the lived experiences, sociocultural nuances and daily operational realities of local stakeholders. Most existing literature examines isolated determinants in controlled settings rather than exploring how community-based promotive and preventive interventions function within complex, real-world isolated endemic environments (13).

Besides environmental determinants, human behavior and community participation substantially influence malaria prevention efforts. Knowledge, attitudes and preventive practices are important determinants of protective behavior against malaria. Communities with better

understanding regarding malaria transmission and prevention are more likely to consistently utilize insecticide-treated bed nets, engage in environmental management practices and seek early treatment (14). Previous studies have demonstrated significant associations between community knowledge, attitudes and malaria incidence, suggesting that improving health literacy may contribute to disease prevention (15).

Community-based approaches have increasingly been recognized as sustainable strategies for malaria control. Health promotion interventions involving health education, local leaders, community health volunteers and participatory activities have shown promising results in improving preventive practices and strengthening community ownership (16). Such interventions align with community empowerment principles emphasizing active participation and collective responsibility in disease prevention.

Various promotive and preventive interventions have been implemented to reduce malaria transmission, including distribution of Long-Lasting Insecticidal Nets (LLINs), Indoor Residual Spraying (IRS), Early Diagnosis and Treatment (EDAT) and malaria surveillance systems (6). Nevertheless, implementation often encounters multiple barriers, including geographical isolation, logistical limitations, inadequate healthcare resources, sociocultural beliefs and insufficient community participation (17). Previous studies primarily focused on environmental risk factors, epidemiological determinants, or technical implementation aspects of malaria programs. However, limited evidence has explored how community-based promotive and preventive interventions are implemented and experienced by stakeholders in highly endemic settings, particularly using qualitative approaches.

Existing literature frequently emphasizes program outcomes and epidemiological indicators while providing limited understanding of contextual experiences among communities, health workers and local stakeholders involved in malaria interventions (16). Understanding these experiences is essential because intervention effectiveness depends not only on resource availability but also on social acceptance, participation, local adaptation and implementation context. Therefore, qualitative exploration using phenomenological approaches may provide deeper insights regarding

barriers and facilitators influencing malaria program implementation (18). The novelty of this study lies in its comprehensive integration of community perspectives, field observations, institutional stakeholder accounts and photovoice visual methodologies into a single analytical framework centered on a high-endemic remote setting in eastern indonesia. Unlike studies focusing solely on technical interventions, this research applies a holistic, community-centered approach to uncover systemic implementation realities. Furthermore, this study formulates an operational conceptual framework linking program inputs (health policy, llin supply, diagnostic resources) and throughput processes (cadre home visits, health education, local leader advocacy) with intermediate outputs (enhanced health literacy, regular bed-net utilization, environmental clearance) to achieve long-term outcomes of reduced api and sustainable malaria elimination. Findings from this research are expected to provide evidence-based insights for public health practitioners and policymakers designing adaptive, context-sensitive malaria elimination strategies in endemic regions. Therefore, this study aims to explore and understand the implementation of community-based promotive and preventive malaria programs in the endemic area of Mindiptana Public Health

Center, Boven Digoel Regency, South Papua, Indonesia. Findings from this study are expected to strengthen evidence-based community intervention strategies and support sustainable malaria elimination initiatives in endemic settings.

Methodology

Study Setting and Coordinates

This study was conducted in the working area of the Mindiptana Public Health Center, Boven Digoel Regency, South Papua, Indonesia. The research location is geographically situated at approximately 5.872093° S latitude and 140.700055° E longitude. The study was conducted from March to July 2025 and focused on community-based promotive and preventive malaria control implementation in an endemic, geographically remote setting.

Selection of Participants and Sampling

Participants were selected using purposive sampling and included 36 informants comprising one regional policymaker, four healthcare workers, twenty-six malaria cadres and five community leaders. Eligible participants were individuals directly involved in malaria control activities who were willing to participate and provide informed consent. Table 1 presents the characteristics of study participants, including their roles, selection criteria and involvement in malaria control activities.

Table 1: Characteristics of Study Informants (n = 36)

Informant Category	n	Primary Selection Criteria / Role Description
Policymakers	1	Senior official at district health office overseeing disease control programs
Healthcare workers	4	Mindiptana health center staff (nurses, sanitarians, malaria program managers)
Malaria cadres	26	Selected village volunteers trained in malaria health promotion and rapid diagnostic testing
Community leaders	5	Formal village heads, traditional tribal chiefs (ondoafi) and religious leaders
Total	36	Comprehensive cross-section of local malaria control stakeholders

Note: n = Total Informants.

Data Collection Procedures and Participant Scope

Data were collected through in-depth interviews, focus group discussions (FGDs), field observations, document reviews and photovoice. Interviews lasted approximately 45–60 minutes, while FGDs lasted 90–120 minutes. The photovoice technique enabled participants to document environmental conditions and community practices related to

malaria prevention, which were subsequently discussed during interviews to enrich the findings.

Methodological Clarification Regarding General Community Members

General community members did not participate in separate, formal individual in-depth interviews or standalone focus groups due to structural community research protocols and cultural governance preferences in the district. Instead,

community perspectives and household behaviors were gathered through the photovoice exercises, direct observational home visits and via malaria cadres and traditional community leaders who serve as institutional representatives of local households.

Reflexivity statement

The research team comprised academic researchers from the department of health promotion and behavioral sciences and department of epidemiology at Hasanuddin university, possessing extensive expertise in qualitative public health methodologies and vector-borne disease control in eastern Indonesia. None of the researchers were permanent residents of Boven Digoel regency, which minimized personal bias regarding local healthcare administration. To establish trust and ensure cultural respect, researchers collaborated with local health managers and indigenous translators. Reflexive field journals were maintained throughout data collection to critically reflect on how the researchers' academic backgrounds might influence data interpretation during interview sessions.

Data Analysis

Data were analyzed using thematic analysis following Braun and Clarke's six-step framework and managed with NVivo software. To ensure the trustworthiness of the findings, methodological and source triangulation, member checking and audit trail documentation were applied. Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Public Health, Hasanuddin University. Written informed consent was obtained from all participants prior to data collection and participant confidentiality and anonymity were maintained throughout the study.

Results

The findings revealed that the implementation of malaria control programs involves the interaction of community knowledge, environmental conditions, program support and the roles of malaria cadres and local leaders. Although participants were generally aware that malaria is transmitted through mosquito bites, this knowledge was not consistently translated into preventive practices. Environmental conditions characterized by the presence of swamps, stagnant water, proximity to forested areas and inadequate-

ly protected housing increased community vulnerability to malaria transmission. Program support was commonly perceived as the availability of healthcare services and logistical assistance; however, limitations in resources and geographical accessibility resulted in uneven program implementation across the study area.

Program success was reflected in the active involvement of malaria cadres, village heads, traditional leaders and religious leaders, who served as key references in community health decision-making. The role of local leaders enhanced community acceptance of malaria prevention and control programs. However, cultural practices and long-standing traditional beliefs remained significant challenges in promoting sustained behavioral change toward malaria prevention. Overall, malaria control efforts in the study area demonstrated gradual and partial achievements, indicating the need for continuous health education, stronger community support and program approaches that are sensitive to the local socio-cultural context.

Perceived Success and Failure of Community-based Malaria Programs

Participants described both positive achievements and persistent challenges in the implementation of malaria prevention programs. Participants specifically highlighted four types of activities that were perceived as successful:

- (a) mass distribution and hanging of long-lasting insecticidal nets (LLINs);
- (b) direct door-to-door health counseling;
- (c) community-wide sanitation campaigns (*kerja bakti*); and
- (d) active case detection via blood smears and rapid diagnostic tests (RDTs) conducted by malaria cadres during home visits.

Several participants reported that health promotion activities improved community awareness regarding malaria symptoms and encouraged early treatment-seeking behavior.

"People now recognize that fever and chills may indicate malaria, which encourages them to seek medical treatment at an earlier stage." (Malaria Cadre)

The involvement of malaria cadres was also perceived as an important component contributing to program implementation, particularly in remote villages where access to healthcare services was limited.

"Malaria cadres act as a vital bridge connecting healthcare providers with local communities, particularly in remote villages." (Healthcare Worker).

Despite these achievements, participants reported several ongoing challenges. Inconsistent use of bed nets, frequent outdoor activities during nighttime and delayed healthcare-seeking behavior remained common within the community.

Socioeconomic constraints heavily influenced these practices; lower-income households lacking electricity often spent evenings outdoors to avoid indoor heat, exposing them to vector bites.

"There are still community members who choose traditional remedies as their initial treatment option before seeking care from formal health services." (Healthcare worker).

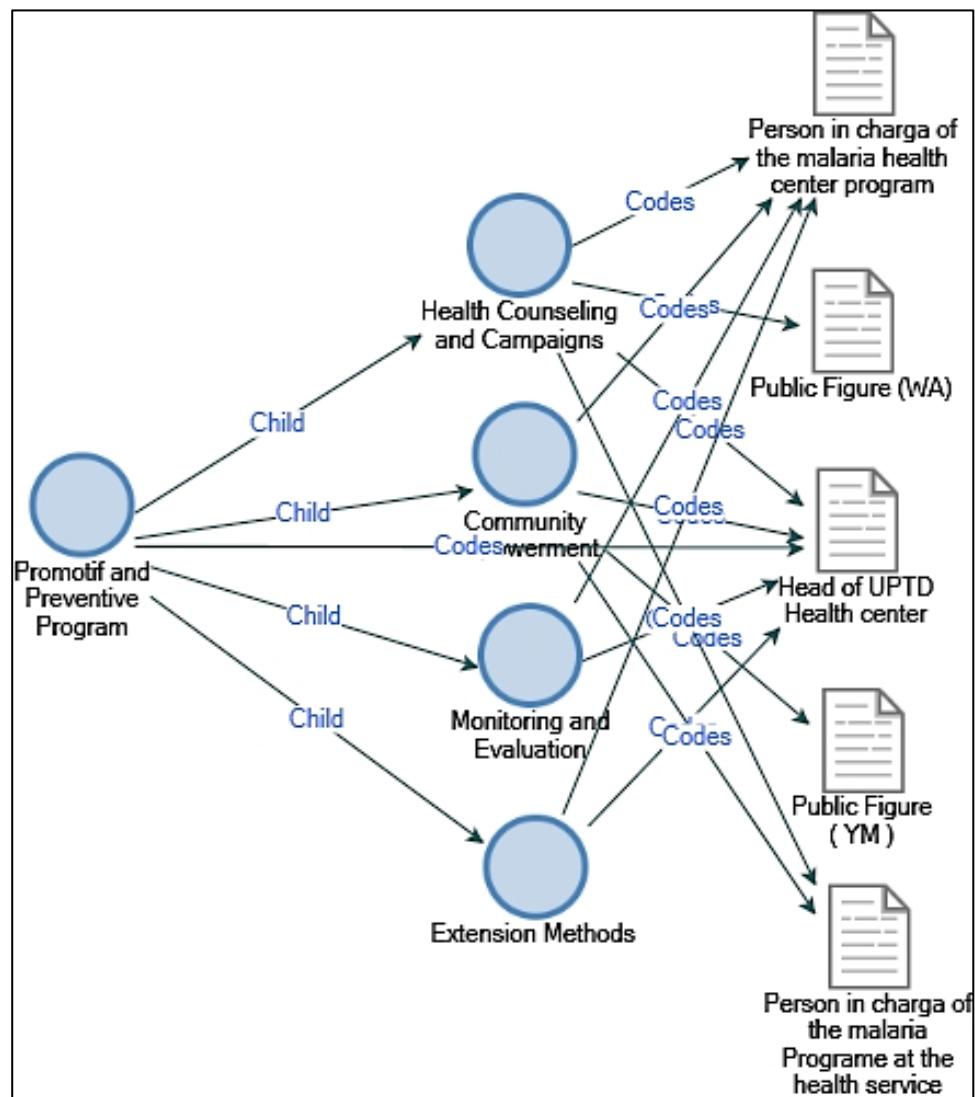


Figure 1: NVivo Hierarchy Chart of Program Successes and Failures

Figure 1 presents an NVivo hierarchy chart illustrating the main components identified in the implementation of promotive and preventive malaria programs. The primary parent node, promotif and preventive program, branches into four core operational sub-nodes: health counseling and campaigns, community empowerment, monitoring and evaluation and extension methods. These nodes connect directly to

qualitative data files representing institutional stakeholders including the person in charge of the malaria program, public figures and the head of the UPTD health center. The hierarchy highlights that health counseling and community empowerment represent the largest thematic categories, demonstrating their central role in perceived program success. Conversely, structural gaps in monitoring and evaluation correlate with reported operational failures.

Program Support and Implementation Barriers

Participants identified multiple forms of support that facilitated malaria prevention activities. These included the involvement of healthcare workers, malaria cadres, community leaders, religious leaders and local government authorities.

Malaria cadres were consistently described as key actors connecting healthcare providers with local communities.

“Malaria cadres act as a vital bridge connecting healthcare providers with local communities, particularly in remote villages.” (Healthcare Worker).

Community leaders were also perceived as influential in encouraging participation in malaria prevention activities and increasing acceptance of health interventions.

At the same time, participants reported several barriers affecting program implementation. Geographic isolation, limited transportation infrastructure, shortages of health personnel and logistical constraints were repeatedly mentioned.

“Several villages are accessible only via river routes, which often leads to delays in the delivery of logistical support and malaria control resources.” (Healthcare Worker)

Cultural beliefs and traditional treatment practices were also reported to influence healthcare-seeking behavior among community members.

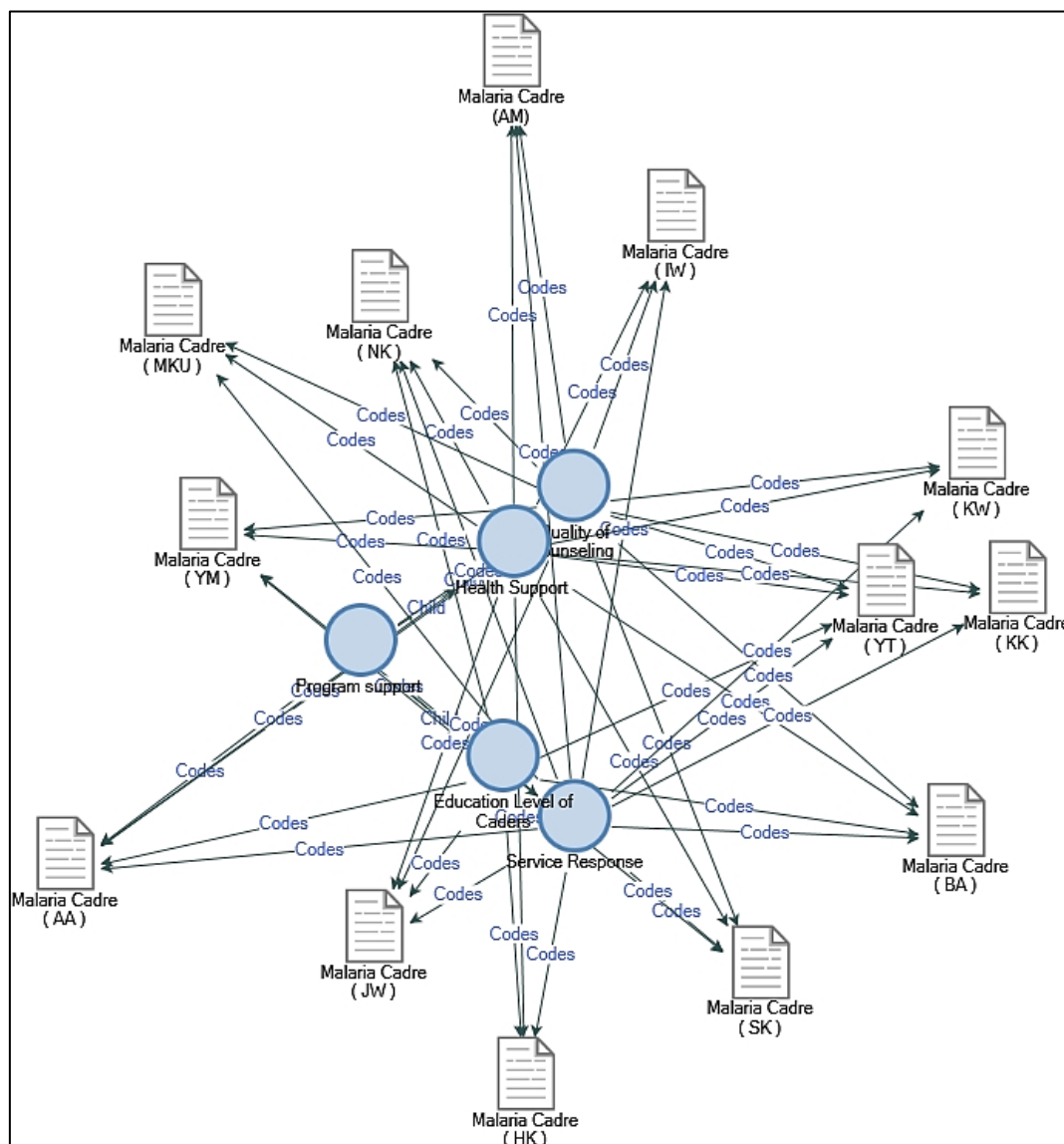


Figure 2: NVivo Project Map of Program Support and Barriers

Figure 2 presents an NVivo project map illustrating the relationships among program support, health support, counseling quality, cadre education level and service response based on participants' accounts. Central thematic nodes program support, health support, quality of counseling, education level of cadres and service response are linked to individual malaria cadre data sources. The map demonstrates that higher cadre educational background and structured health support directly enhance the quality of health counseling and service response times. Conversely, weak health support links to reduced service response in remote riverine villages.

Environmental Conditions and Community Knowledge Related to Malaria Prevention

Environmental conditions and community knowledge emerged as interconnected factors influencing malaria transmission and prevention practices within the study area. Participants consistently described the physical environment surrounding their settlements as highly conducive to mosquito breeding and malaria transmission.

Frequently reported environmental characteristics included swampy areas, stagnant water bodies, dense vegetation, proximity to forests and high rainfall throughout the year. These environmental conditions were perceived to increase mosquito density and facilitate continuous malaria transmission within the community.

"The village is surrounded by swamps and stagnant water, which provide suitable breeding sites for mosquitoes. As a result, mosquito density increases during the rainy season, accompanied by a rise in malaria cases." (Community Leader)

Field observations further confirmed the presence of environmental conditions that potentially support mosquito breeding, including unmanaged standing water, dense vegetation around houses and inadequate drainage systems. Several participants also reported that many houses lacked protective barriers such as wire screens, allowing mosquitoes to enter residential areas easily.

In addition to environmental factors, participants discussed their knowledge regarding malaria

transmission, symptoms and prevention. Most informants correctly identified mosquito bites as the primary mode of malaria transmission and recognized common symptoms such as fever, chills, headache and body weakness.

"Whenever we develop high fever accompanied by chills, we immediately suspect malaria and seek care at a health facility." (Community Member)

Participants also described various preventive measures commonly promoted by healthcare workers and malaria cadres, including the use of insecticide-treated bed nets, mosquito repellents, environmental sanitation and early treatment seeking.

"Healthcare workers consistently encourage community members to sleep under insecticide-treated bed nets and maintain a clean environment as part of malaria prevention efforts." (Malaria Cadre)

Despite a relatively good level of biomedical knowledge, several misconceptions remained. Some participants associated malaria with weather changes or certain foods. Socioeconomic analysis revealed that low-income households and isolated river settlements were disproportionately affected. These groups faced dual vulnerabilities: higher environmental exposure due to substandard housing lacking window screens and restricted access to health facilities during emergency malaria episodes.

Figure 3 presents the NVivo project map illustrating the relationships between participant perspectives and the main themes related to community knowledge and environmental conditions. Five prominent coding categories are identified: malaria knowledge, malaria training, causes of malaria, geographical and environmental factors and drug and insecticide resistance. The connections show that structured malaria training provided to cadres directly improves community awareness of preventive measures. However, persistent gaps in environmental management and emerging concerns regarding drug and insecticide resistance highlight ongoing vulnerabilities across remote communities.

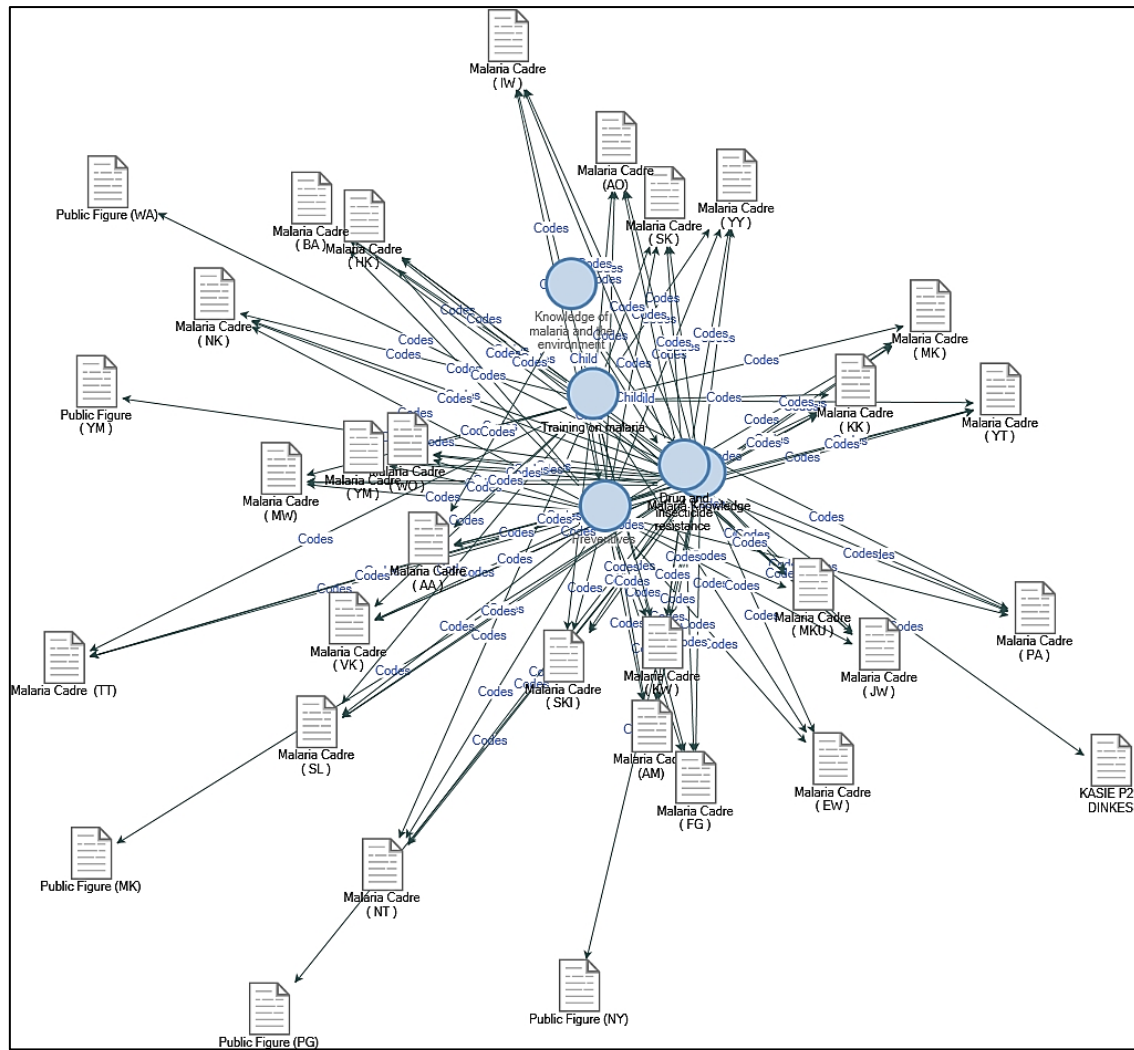


Figure 3: NVivo Project Map Showing Community Knowledge and Environmental Conditions Related to Malaria Prevention

Discussion

This study explored the implementation of community-based promotive and preventive malaria programs in an endemic area of South Papua and revealed that program effectiveness is influenced by a complex interaction of community knowledge, environmental conditions, program support, sociocultural factors and the active involvement of local stakeholders. The findings highlight that malaria control is not solely determined by the availability of health interventions but also by the extent to which communities adopt preventive behaviors and participate in control activities.

The study found that health education, distribution of insecticide-treated bed nets and the involvement of malaria cadres were perceived as the most successful components of malaria prevention programs. Participants reported increased aware-

ness of malaria symptoms and improved treatment-seeking behavior following health promotion activities. These findings are consistent with previous studies demonstrating that community-based educational interventions improve malaria-related knowledge and encourage preventive practices such as early diagnosis and treatment seeking (15). Health education serves as an important mechanism for enhancing health literacy, enabling individuals to recognize symptoms, understand transmission pathways and adopt appropriate preventive measures (19). Furthermore, the strong role of malaria cadres identified in this study supports evidence suggesting that community health volunteers can significantly improve the reach and effectiveness of malaria interventions, particularly in geographically isolated settings where formal healthcare services are limited (16).

Despite these positive achievements, the findings revealed persistent gaps between knowledge and behavior. Although most participants correctly identified mosquito bites as the primary cause of malaria and were familiar with preventive measures, consistent utilization of bed nets and other protective practices remained suboptimal. Similar observations have been reported in other endemic regions where knowledge alone was insufficient to produce sustained behavioral change (14). This discrepancy may be explained by behavioral, cultural and contextual factors that influence individual decision-making. The Health Belief Model suggests that preventive behavior is affected not only by knowledge but also by perceived susceptibility, perceived barriers, social norms and environmental constraints. In the present study, discomfort associated with bed-net use, outdoor nighttime activities and reliance on traditional healing practices may have reduced adherence to recommended preventive measures. Environmental conditions emerged as a major determinant of malaria transmission within the study area. Participants consistently described swampy landscapes, stagnant water bodies, dense vegetation and proximity to forests as conditions favoring mosquito breeding. Field observations further confirmed the presence of environmental characteristics that support vector proliferation. These findings align with previous studies demonstrating that environmental factors such as standing water, inadequate drainage systems and tropical climatic conditions significantly contribute to malaria transmission dynamics (9). Papua's ecological characteristics create favorable habitats for multiple *Anopheles* species, thereby increasing transmission risk and complicating malaria control efforts. The strong relationship between environmental conditions and malaria occurrence observed in this study reinforces the importance of integrating environmental management strategies into community-based malaria interventions.

These findings are consistent with previous Geographic Information System (GIS)-based spatial analyses, which demonstrated that mapping malaria distribution can identify high-risk locations and support more targeted surveillance and intervention strategies (20). Another important finding concerns the critical role of community support systems in facilitating

program implementation. Malaria cadres, community leaders, traditional leaders, religious leaders and healthcare workers were perceived as influential actors who strengthened community engagement and increased acceptance of malaria prevention programs. Their involvement contributed to trust-building and facilitated communication between health authorities and local communities. These findings support community empowerment theories emphasizing the importance of local ownership and participatory approaches in public health interventions (16).

Previous research has demonstrated that interventions involving respected local leaders are more likely to achieve community acceptance and long-term sustainability because health messages are delivered through trusted social structures (21). These findings are consistent with previous studies demonstrating that positive deviance within communities can strengthen malaria prevention through locally adapted behaviors and the active involvement of community health cadres (22). Such community-driven practices have been shown to improve malaria prevention and promote sustainable health behaviors in endemic settings (23).

However, the study also identified significant implementation barriers related to geographical isolation, limited transportation infrastructure, shortages of health personnel and logistical constraints. Several villages could only be accessed through river transportation, resulting in delays in the delivery of medicines, diagnostic tools and preventive supplies. Similar challenges have been documented in rural and remote settings where healthcare accessibility remains a major obstacle to effective disease control (17). Previous evidence has also highlighted that sustaining malaria services in remote endemic areas requires strong community health worker integration, continuous program support and adaptive implementation strategies (24). Geographic barriers may reduce the frequency of supervision, limit access to health services and hinder timely implementation of malaria interventions. These findings indicate that strengthening logistical systems and improving transportation access are essential components of malaria elimination strategies in remote endemic regions.

Sociocultural factors also emerged as important determinants influencing malaria prevention and treatment-seeking behaviors. Some participants continued to associate malaria with non-biomedical causes such as weather changes and certain foods, while others preferred traditional remedies before seeking formal healthcare services (25). These findings suggest that cultural beliefs continue to shape health-related decisions and may delay appropriate treatment. Similar observations have been reported in several endemic regions where traditional explanatory models coexist with biomedical knowledge, influencing healthcare utilization patterns (14). Therefore, malaria control programs should incorporate culturally sensitive communication strategies that acknowledge local beliefs while promoting evidence-based prevention and treatment practices.

The findings of this study support the growing recognition that malaria control requires integrated approaches that address environmental, behavioral, social and health system determinants simultaneously. While technical interventions such as LLIN distribution, early diagnosis and surveillance remain essential, their effectiveness depends on community participation, local leadership and contextual adaptation (16). The present study extends existing literature by demonstrating how these factors interact within a highly endemic setting in South Papua. Unlike previous studies focusing primarily on epidemiological indicators or technical program implementation, this research provides deeper insights into stakeholder experiences and community realities that shape malaria prevention outcomes.

From a policy perspective, the findings suggest that malaria elimination efforts in endemic regions should prioritize continuous community education, strengthening of malaria cadres, expansion of community participation mechanisms and improvement of logistical support systems. Furthermore, interventions should be tailored to local sociocultural contexts and environmental conditions to ensure sustainability and effectiveness. Strengthening partnerships among health authorities, community leaders, local governments and community-based organizations may further enhance program ownership and long-term success.

Overall, the study demonstrates that community-based promotive and preventive malaria programs have contributed to improved awareness and partial behavioral change in Mindiptana. However, sustained malaria reduction will require stronger integration of environmental management, culturally responsive health promotion, community empowerment and equitable access to health services. These findings provide important evidence for developing more context-sensitive malaria elimination strategies in Papua and other highly endemic settings.

Conclusion

This study shows that community-based promotive and preventive malaria control programs in the Mindiptana Public Health Center area improved malaria awareness, treatment-seeking behavior and preventive efforts through health education, LLIN distribution, active case detection, home visits and the involvement of malaria cadres and local leaders. The findings indicate that malaria control in this endemic and geographically remote setting depends not only on the availability of technical interventions, but also on community participation, local leadership, cultural acceptance, environmental conditions and the capacity of health workers and malaria cadres to reach households consistently. The involvement of malaria cadres, village leaders, traditional leaders and religious leaders played an important role in strengthening trust, supporting health communication and increasing community acceptance of malaria prevention messages.

Despite these positive contributions, several challenges continue to affect the sustainability of malaria control efforts in Mindiptana. Geographical isolation, limited transportation access, logistical constraints, environmental risk conditions and sociocultural beliefs remain major barriers to consistent implementation. Some villages are difficult to access, particularly those that depend on river transportation, which may delay the delivery of medicines, diagnostic tools, LLINs and other malaria control resources. Environmental conditions such as swamps, stagnant water, dense vegetation, inadequate drainage and houses without sufficient mosquito protection also increase the risk of continued transmission. In addition, although community knowledge of malaria symptoms and mosquito-

borne transmission was relatively good, this knowledge did not always lead to consistent preventive behavior. Nighttime outdoor activities, discomfort in using bed nets, reliance on traditional remedies and limited household resources may reduce adherence to recommended prevention practices.

The findings highlight the need for a more integrated and context-sensitive malaria control strategy. Continuous health education should be combined with stronger logistical support, environmental management, active community empowerment and culturally appropriate communication. Strengthening the capacity of malaria cadres is also essential, particularly in remote villages where formal health services may be difficult to access. Sustainable malaria elimination in Mindiptana requires collaboration among health authorities, public health centers, malaria cadres, local government, community leaders and households. Such collaboration is important to ensure that malaria control interventions are not only delivered, but also understood, accepted and practiced by the community.

This study has several limitations. The qualitative design and purposive sampling approach may limit the transferability of the findings to other endemic settings. In addition, community perspectives were mainly explored through malaria cadres, community leaders, observations and photovoice activities rather than through separate formal interviews with general community members. Therefore, the findings should be interpreted as stakeholder-based perspectives on community malaria prevention in Mindiptana. Future research should apply longitudinal or mixed-method approaches to evaluate the effectiveness of community-based interventions over time. Further studies should also explore direct household experiences, culturally adapted health promotion models, environmental management interventions and technology-supported strategies to strengthen malaria surveillance, early diagnosis and sustainable elimination efforts in remote endemic areas.

Abbreviations

API: Annual Parasite Incidence, EDAT: Early Diagnosis and Treatment, FGD: Focus Group Discussion, GIS: Geographic Information System,

IRS: Indoor Residual Spraying, LLIN: Long-Lasting Insecticidal Net, WHO: World Health Organization.

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Author Contributions

Muhamad Safwan Karepesina: Writing - Original Draft, Methodology, Software, Muhammad Syfar: Conceptualization, Investigation, Supervision, Writing - Review and Editing, Suriah Suriah: Investigation, Writing - Original Draft, Validation, Andi Zulkifli: Supervision, Writing - Review and Editing, Shanti Riskiyani: Investigation, Supervision, Writing - Review and Editing. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declares that they have no competing interests.

Data Availability

The data that support the findings of this study are available from the corresponding author.

Declaration of Artificial Intelligence (AI) Assistance

During the preparation of this manuscript, the authors used artificial intelligence-assisted tools, including ChatGPT and Grammarly, solely for language improvement, proofreading and enhancement of manuscript clarity and readability. These tools were not used to generate research data, conduct data analysis, interpret study findings, or develop scientific conclusions.

All figures, tables and visual materials presented in this manuscript were prepared and reviewed by the authors based on the original research data and analytical process. The authors generated the figures from their qualitative data analysis and did

not create, modify, or manipulate them using artificial intelligence tools.

The authors critically reviewed and verified all AI-assisted outputs and take full responsibility for the originality, accuracy, interpretation and scientific integrity of the final manuscript.

Ethics Approval

Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Public Health, Hasanuddin University, with approval number [1902/UN4.14.1/TP.01.02/2025]. Written informed consent was obtained from all participants prior to data collection and participant confidentiality and anonymity were maintained throughout the study.

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