Volume 1 Number 1, 2026
Krakatoa Community Service Journal (KCSJ)
STIE KRAKATAU, Indonesia

Malaria Disease Prevention Socialization In Gebang Village, Teluk Pandan District, Pesawaran Regency

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ARTICLE INFO

Received: 4 January 2026;
Revised: 28 January 2026;
Revised: 12 Februari 2026;
Accepted: 8 March 2026;
Volume 1, Number 1
2026, pp 1-15
https://doi.org/10.61401/kcsj.v1i1.538

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ABSTRACT

Purpose: This community service study aimed to improve public knowledge and awareness of malaria causes, symptoms, transmission, and prevention among residents of Gebang Village, Lampung, while encouraging better environmental sanitation and preventive behavior.
Methodology: The program applied a community-based education approach by KKN students through counseling, discussions, Q&A sessions, and distribution of educational materials at village gathering points.
Results: The program improved community understanding of malaria and increased awareness of prevention practices, including mosquito net use, environmental cleanliness, and early treatment seeking.
Conclusions: Community-based education effectively improves malaria awareness and supports preventive health behavior in rural communities, contributing to long-term disease control efforts.
Limitations: The study was limited to a single village and did not include quantitative measurement or long-term follow-up of behavioral changes, which restricts generalizability and impact evaluation over time.
Contributions: This program highlights the importance of student-led community education in strengthening public health awareness and malaria prevention at the village level.

Keywords: *Awareness, Community Education, Health Promotion, Malaria Prevention, Rural Health*

How to Cite: Zulfa, Z., Nuraldi, M. R., Triutama, A., & Yuliansyah, Y. (2026). Malaria Disease Prevention Socialization In Gebang Village, Teluk Pandan District, Pesawaran Regency. *Krakatoa Community Service Journal (KCSJ)*, 1(1), 1-15.

1. Introduction

Malaria is a parasitic infectious disease that continues to represent a major global public health burden, particularly in tropical and subtropical regions where environmental conditions strongly support vector proliferation. The disease is caused by protozoan parasites of the genus Plasmodium, which are transmitted through the bite of infected female Anopheles mosquitoes. Its complex biological cycle involves both human and mosquito hosts, making transmission control particularly challenging. Clinically, malaria manifests through fever, chills, hemolytic anemia, and severe complications that may lead to mortality if untreated. Despite advances in treatment, malaria

persistence is influenced by parasite adaptability and resistance to antimalarial drugs, which further complicates elimination efforts (Ashley, & Phyo, 2023; Dondorp, Nosten, Yi, Das, Phyo, & Tarning, 2015).

At the global level, malaria continues to affect hundreds of millions of individuals annually, with the highest burden concentrated in endemic tropical regions. Effective disease management depends on early diagnosis, rapid treatment, and combination therapies such as artemisinin-based drugs. However, global malaria control is increasingly challenged by antimalarial drug resistance and insecticide-resistant mosquito vectors, which reduce intervention effectiveness. Large-scale analyses have shown that although global malaria incidence has declined, transmission remains persistent in high-risk ecological zones, particularly in low-income tropical countries (World, 2023; Bhatt, 2015; Hay, Battle, Pigott, Smith, Moyes, & Bhatt, 2013).

In Indonesia, malaria remains a regionally distributed public health problem influenced by ecological diversity, socioeconomic conditions, and uneven health system capacity. As an archipelagic country with diverse ecosystems including coastal areas, forests, wetlands, and highlands, malaria transmission patterns vary significantly across regions. The national malaria elimination program targets malaria-free status by 2030 through strengthened surveillance, vector control, and community engagement strategies. However, environmental vulnerability and limited health infrastructure in rural regions continue to hinder progress toward elimination, particularly in endemic areas.

Lampung Province, particularly Pesawaran Regency, is identified as one of the malaria-endemic areas in Sumatra with a moderate Annual Parasite Incidence (API). Transmission in this region is strongly associated with environmental determinants such as stagnant water bodies, agricultural drainage systems, and coastal wetlands that provide ideal breeding sites for Anopheles mosquitoes. Coastal ecological systems have been shown to significantly increase vector density and transmission risk, especially in communities with limited environmental sanitation management. Gebang Village in Teluk Pandan District represents a vulnerable area where environmental conditions and human activity interact to sustain malaria transmission (Dinas, 2021; Tusting, 2019).

In response to these conditions, community-based health education has been widely recognized as an essential strategy for malaria prevention and control. Participatory health promotion programs can significantly improve knowledge, attitudes, and preventive behaviors among rural populations. Student-led Community Service Programs (KKN) serve as an effective bridge between academic knowledge and community needs by delivering direct educational interventions. Evidence suggests that community empowerment combined with environmental awareness plays a critical role in reducing malaria risk and strengthening sustainable prevention practices at the village level (Sari, Rahayu, & Wulandari, 2022).

2. Literature Review

Malaria remains one of the most persistent vector-borne diseases and continues to pose a significant global health burden, particularly in tropical and subtropical regions. The disease is caused by Plasmodium parasites and transmitted through the bite of infected female Anopheles mosquitoes. Despite decades of control efforts, malaria transmission remains sustained due to ecological suitability, human mobility, and biological adaptability of the parasite. Recent literature emphasizes that malaria cannot be eliminated solely through medical treatment, but requires integrated interventions combining vector control, environmental management, and community participation (World, 2023 ; Bhatt, Weiss, Cameron, Bisanzio, Mappin, & Dalrymple, 2015). In endemic countries, the disease remains closely linked to poverty, poor sanitation, and limited access to health services.

From an epidemiological perspective, malaria transmission is strongly influenced by environmental determinants such as rainfall patterns, stagnant water availability, humidity, and temperature variation. Studies show that mosquito breeding habitats are highly dependent on ecological stability, particularly in coastal and rural regions where drainage systems are inadequate (Tusting, 2019). Environmental modification, including housing improvement and drainage management, has been

shown to significantly reduce malaria incidence by limiting human-vector contact. Furthermore, climate change has intensified transmission risks by expanding mosquito habitats into previously non-endemic regions, making malaria control increasingly complex in the last decade (Lindsay & Martens, 2018).

In addition to environmental factors, socioeconomic conditions play a critical role in malaria vulnerability. Populations with low income, limited education, and poor housing quality are significantly more exposed to mosquito bites due to inadequate protective measures such as bed nets or screened housing. Research indicates that behavioral factors, including nighttime outdoor activities and lack of awareness of preventive practices, significantly increase infection risk in rural communities (Alonso, 2019). Therefore, malaria prevention requires not only medical intervention but also sustained behavioral change supported by education and community empowerment.

Vector resistance and drug resistance have become major challenges in malaria control programs worldwide. The emergence of artemisinin resistance in Southeast Asia and insecticide resistance in Anopheles mosquitoes has reduced the effectiveness of existing interventions. These challenges threaten global malaria elimination targets and require adaptive strategies such as combination therapies, new insecticide formulations, and continuous surveillance systems (Dondorp, Nosten, Yi, Das, Phyo, & Tarning, 2015; Hemingway, 2016). Studies highlight that resistance patterns vary geographically, making localized intervention strategies essential for effective control.

Community-based interventions have been widely recognized as one of the most effective approaches to reducing malaria transmission at the grassroots level. Health education programs significantly improve knowledge, attitudes, and preventive behaviors, especially when delivered through participatory approaches. Evidence suggests that community engagement increases compliance with preventive measures such as bed net usage, environmental cleaning, and early treatment-seeking behavior (Sari, Rahayu, & Wulandari, 2022). Furthermore, student-led outreach programs, such as Community Service Programs (KKN), have proven effective in bridging the gap between public health knowledge and community practice in rural areas.

In Indonesia, malaria remains a regionally endemic disease with varying incidence rates across provinces due to diverse ecological and socioeconomic conditions. Eastern and coastal regions are particularly vulnerable due to high mosquito density and limited health infrastructure. The Indonesian government has implemented a national malaria elimination strategy targeting a malaria-free status by 2030 through surveillance strengthening, vector control, and community participation (Kementerian, 2022). However, challenges such as environmental risk persistence, low public awareness, and uneven health system coverage continue to hinder progress toward elimination goals.

Recent studies also emphasize the importance of integrated malaria control strategies that combine environmental management, vector control, and health promotion. Mathematical and epidemiological models show that reducing mosquito-human contact significantly lowers the basic reproduction number (R_0), thereby reducing transmission potential (Kamgang & Thron, 2018). Additionally, long-term data analysis demonstrates that sustained interventions such as insecticide-treated nets and indoor residual spraying can significantly reduce malaria mortality when consistently implemented (Baidoo, 2025). Therefore, sustainable malaria control requires continuous adaptation of strategies based on local ecological and social conditions, particularly in vulnerable rural areas such as Gebang Village.

3. Methodology

3.1 Research Design

This study employed a Community-Based Participatory Research (CBPR) design combined with a descriptive qualitative approach to examine the implementation and effectiveness of malaria prevention education in Gebang Village, Teluk Pandan District, Pesawaran Regency, Lampung, Indonesia. The CBPR approach was selected because it emphasizes collaborative engagement between researchers and community members in identifying health problems, implementing interventions, and evaluating outcomes in a shared learning process. In this study, the researchers

collaborated with university students participating in the Community Service Program (KKN) from Universitas Lampung and Universitas Sultan Ageng Tirtayasa, who acted as facilitators in delivering malaria health education to the community.

CBPR is widely recognized as an effective methodological framework in public health because it integrates scientific knowledge with local community experience, ensuring that interventions are contextually relevant and socially sustainable. Previous studies have shown that participatory approaches significantly improve malaria-related knowledge, attitudes, and preventive practices among rural populations in endemic regions (Kismiyati et al., 2026; Wallerstein & Duran, 2020). Furthermore, participatory malaria education has been found to increase community ownership of health interventions and strengthen behavioral change compared to conventional top-down health campaigns (Onyango et al., 2021; Reyal et al., 2024). The descriptive qualitative design was applied to explore the social dynamics, perceptions, and behavioral responses of community members toward malaria prevention education. This approach allows for a deeper understanding of how individuals interpret malaria risk, environmental sanitation, and preventive actions in their daily lives. Rather than focusing on statistical generalization, this study emphasizes contextual interpretation and lived experiences of community members in malaria-prone environments.

3.2 Research Setting, Participants, and Location

The research was conducted in Gebang Village, Teluk Pandan District, Pesawaran Regency, Lampung Province, Indonesia, a coastal rural area characterized by wetlands, agricultural drainage systems, and stagnant water bodies that provide favorable breeding habitats for *Anopheles* mosquitoes. The village is categorized as a malaria-prone area based on regional health reports and environmental conditions that support vector proliferation (Kementerian, 2022; World, 2023). Environmental studies indicate that malaria transmission is strongly influenced by ecological conditions such as humidity, rainfall patterns, and water stagnation, which directly affect mosquito population density (Tusting, 2019). Coastal rural communities such as Gebang Village are particularly vulnerable due to limited sanitation infrastructure and low public awareness of vector control practices.

Participants in this study included 40–80 community members per session, consisting of household heads, women groups, youth representatives, and local community leaders. The inclusion of diverse demographic groups was intended to ensure comprehensive dissemination of malaria prevention knowledge across all household levels. Studies confirm that community-wide participation is essential for achieving sustainable behavioral change in malaria prevention programs (Bhatt, Weiss, Cameron, Bisanzio, Mappin, & Dalrymple, 2015; Sabneno, & Junias, 2025). Participation was voluntary and coordinated with village authorities to ensure ethical engagement and community acceptance. The involvement of multiple social groups reflects the CBPR principle of inclusive participation, which strengthens program sustainability and knowledge retention (Israel, Eng, Schulz, & Parker, 2018).

3.3 Data Collection Techniques, Procedure, and Intervention Implementation

Data collection was conducted using triangulated qualitative methods, including observation, semi-structured interviews, documentation, and participatory health education sessions. Direct observation was used to assess environmental risk factors such as stagnant water, waste accumulation, and mosquito breeding sites in the village environment. Semi-structured interviews were conducted with village officials and selected residents to determine baseline knowledge regarding malaria transmission, symptoms, and prevention practices. Documentation techniques included photographic records, field notes, and educational materials distributed during the intervention. These records were used to validate the implementation process and ensure transparency of community engagement activities. Additionally, participatory health education sessions served both as an intervention and as a data collection platform, allowing researchers to observe real-time behavioral responses and engagement levels.

The intervention process was divided into three structured phases: preparation, implementation, and evaluation. During the preparation phase, researchers conducted field surveys, coordinated with village authorities, and developed malaria education materials tailored to local literacy levels and

environmental conditions. Educational content included malaria transmission cycles, symptoms, risk factors, and preventive strategies such as mosquito net usage, environmental sanitation, and elimination of stagnant water sources. During the implementation phase, health education sessions were conducted at the village hall through interactive lectures, visual presentations, group discussions, and question-and-answer sessions. This participatory method aligns with evidence suggesting that interactive education significantly improves malaria prevention knowledge and behavioral outcomes compared to passive learning methods (Kismiyati et al., 2026; Tairou et al., 2022).

3.4 Data Analysis Technique

Data analysis in this study followed an interactive qualitative analysis model that consists of three main stages, namely data reduction, data display, and conclusion drawing. The data reduction process involved systematically selecting, simplifying, and focusing relevant information obtained from field observations, semi-structured interviews, and documentation collected during the malaria education program in Gebang Village. This stage was essential to filter raw data into meaningful units of analysis, particularly those related to community knowledge, perceptions, and responses toward malaria prevention activities. Irrelevant or repetitive information was excluded to ensure that the analysis remained focused on key thematic aspects of the study, such as awareness of malaria transmission, environmental sanitation practices, and participation in health education sessions (Miles et al., 2019; Creswell & Creswell, 2018).

The second stage, data display, involved organizing the reduced data into structured thematic categories to facilitate interpretation and pattern identification. The data were classified into several key themes, including improvement of community knowledge regarding malaria, behavioral intention toward preventive practices, environmental awareness related to mosquito breeding sites, and the level of community participation during educational interventions. This structured presentation of data allowed the researchers to visually and conceptually map the relationships between community engagement and changes in health-related understanding. By displaying the data in thematic form, the analysis became more systematic and enabled a clearer identification of trends emerging from the community responses during and after the malaria socialization activities.

The final stage, conclusion drawing, was conducted by identifying recurring patterns and relationships across multiple data sources, including observations, interview responses, and documentation records. These patterns were then interpreted to determine the overall effectiveness of the malaria education intervention in increasing community awareness and promoting preventive behavior. The conclusions were strengthened through triangulation, ensuring that findings were consistent across different data collection methods. This analytical approach is widely supported in qualitative public health research, as it enables researchers to capture complex social phenomena and behavioral changes in a structured yet flexible manner. Recent studies in malaria-endemic regions also confirm that thematic and interactive qualitative analysis is more effective than purely quantitative approaches in evaluating community-based health interventions, as it better captures behavioral transformation and social dynamics within rural populations (Onyango et al., 2022; Sabneno & Junias, 2025).

3.5 Ethical Considerations

Ethical considerations in community-based health interventions are a fundamental aspect of ensuring participant safety, informed consent, and respect for cultural values. In this study, ethical principles were strictly applied throughout the implementation of the malaria education program in Gebang Village. Prior to participation, all community members were provided with clear explanations regarding the objectives, procedures, and expected outcomes of the program. This ensured that participants had sufficient understanding before deciding to engage in the activities. Informed consent was obtained verbally from all participants, reflecting the practical and community-oriented nature of the intervention, where written procedures were adapted to local social conditions. Participation was entirely voluntary, and individuals were free to withdraw at any stage without any consequences, thereby ensuring respect for autonomy and individual decision-making rights.

In addition to informed consent, cultural sensitivity and respect for local traditions were maintained throughout the entire intervention process. The research team, in collaboration with KKN students, ensured that all educational activities were delivered in a manner consistent with local norms, values, and community structures. This approach helped to build trust between facilitators and community members, which is essential in public health interventions that rely on active participation. Engagement with village authorities played a key role in coordinating activities, ensuring that the program aligned with community needs and did not interfere with daily social or economic activities. Such collaboration also strengthened acceptance of the program and increased participation rates among residents, demonstrating the importance of culturally responsive health interventions in rural settings.

Furthermore, the ethical framework applied in this study is grounded in the principles of community-based participatory research (CBPR), which emphasizes shared decision-making, mutual respect, and reciprocal benefits between researchers and communities. This approach ensures that interventions are not externally imposed but are developed and implemented collaboratively with local stakeholders. Ethical engagement in CBPR is not only limited to obtaining consent but also includes continuous communication, transparency, and accountability throughout the research process. Previous studies highlight that ethical CBPR practices enhance community trust and improve the sustainability of health interventions, particularly in infectious disease prevention programs such as malaria control (Wallerstein & Duran, 2020; Israel et al., 2018). Therefore, the ethical dimension of this study serves as a critical foundation for ensuring both the scientific integrity and social acceptability of the malaria education intervention.

3.6 Methodological Strength and Limitations

The methodological strength of this study lies in its participatory design, which actively engages community members not only as recipients of information but also as key actors in the learning, discussion, and implementation processes. Such an approach fosters a sense of ownership and responsibility toward malaria prevention efforts, thereby increasing the likelihood that the promoted practices will be adopted and maintained over time. Through interactive educational sessions, environmental observation activities, and collaborative discussions, participants were encouraged to relate malaria prevention strategies to their daily experiences and local environmental conditions. Previous studies have demonstrated that participatory health interventions can significantly improve knowledge retention, strengthen community empowerment, and facilitate sustainable behavioral changes in malaria-endemic settings. Furthermore, community-based malaria programs that involve active participation from local residents have been reported to be more effective in promoting preventive behaviors, including consistent bed net utilization, elimination of mosquito breeding sites, environmental sanitation, and early treatment-seeking practices (Onyango et al., 2021; Reyal et al., 2024). These findings support the relevance of participatory approaches as an effective strategy for enhancing malaria prevention awareness and community resilience.

Despite these strengths, several limitations should be acknowledged. First, the study did not employ quantitative evaluation instruments, such as pre-test and post-test assessments, which could have provided objective measurements of changes in participants' knowledge, attitudes, and preventive behaviors following the intervention. The absence of statistical analysis limits the ability to determine the magnitude of the program's impact and to establish stronger evidence regarding its effectiveness. Second, the findings were derived from a single village context, which may restrict their generalizability to other malaria-endemic areas characterized by different socio-economic, cultural, environmental, and epidemiological conditions. Variations in community structure, health service accessibility, and local perceptions of malaria may influence the outcomes of similar interventions elsewhere. Therefore, future studies are encouraged to adopt mixed-method research designs that combine quantitative and qualitative approaches to provide a more comprehensive evaluation of program effectiveness. Longitudinal follow-up assessments are also recommended to examine the sustainability of behavioral changes over extended periods and to identify factors that facilitate or hinder the long-term success of community-based malaria prevention initiatives.

4. Results and Discussion

4.1 Result

The malaria prevention socialization program conducted by KKN students from Universitas Lampung and Universitas Sultan Ageng Tirtayasa in Gebang Village, Teluk Pandan District, Pesawaran Regency yielded measurable outcomes across three interconnected stages: preparation, implementation, and evaluation. These stages formed a coherent action-research cycle consistent with community-based participatory health interventions documented in the literature (Onyinyechi & Ismail, 2023). The results are presented below in the sequence that these stages unfolded.

4.2 Preparation Stage Results

During the preparation stage, a community health needs assessment was conducted through direct field observation and structured discussions with village officials and community representatives. The assessment revealed that a significant proportion of Gebang Village residents possessed limited knowledge regarding the etiology, transmission pathways, clinical manifestations, and preventive strategies of malaria. This finding is consistent with evidence from comparable rural coastal settings in Indonesia, where ecological conditions characterized by wetlands, tidal canals, and stagnant brackish pools create persistently high Anopheles breeding pressure, yet community awareness of the associated transmission risk remains disproportionately low (Bandzuh, Ernst, Gunn, Pandarangga, Yowi, Hobgen, Cavanaugh, Kalaway, Kalunga, Killa, Ara, Uejio, & Hayden, 2022). Following the needs assessment, a context-specific educational module was collaboratively developed by the student team in consultation with village health cadres, integrating locally relevant examples of breeding sites and emphasizing behavioral changes achievable within the socioeconomic constraints of the target population (Guntur, Lobo, Sihotang, Bria, & Kusumaningrum, 2025).

Table 1. Summary of Socialization Program Activities, Components, and Outcomes

Stage	Activity	Details	Outcome
Preparation	Site survey & community coordination	Field observation, discussion with village officials, material development	Identified knowledge gaps; tailored materials prepared
Implementation	Interactive socialization at village hall	Presentation, leaflet distribution, Q&A session, mosquito net demonstration	Active participation; enthusiastic community response
Evaluation	Post-activity Q&A and oral assessment	Direct questioning on causes, symptoms, prevention; feedback collected	Marked improvement in community understanding

Table 1 shows that the community service program was conducted through three sequential stages: preparation, implementation, and evaluation. During the preparation stage, a site survey and coordination meetings were carried out with village officials to identify local malaria-related knowledge gaps and community needs. Field observations and discussions provided valuable insights that guided the development of educational materials tailored to the local context. The implementation stage consisted of an interactive socialization session held at the village hall, which included presentations on malaria causes, symptoms, transmission, and prevention strategies. Educational leaflets were distributed to reinforce key messages, while question-and-answer sessions and mosquito net demonstrations encouraged active community engagement and practical learning. Community members participated enthusiastically throughout the activity, demonstrating strong interest in malaria prevention. The evaluation stage involved post-activity questioning and oral assessments to assess participants' understanding of the information delivered. Feedback was also collected from participants regarding the relevance and usefulness of the program. The evaluation results indicated a noticeable improvement in community knowledge and awareness of malaria prevention measures, suggesting that the socialization activities effectively enhanced participants' understanding of the disease and its control strategies.

4.3 Multicollinearity

The socialization session was held at the Gebang Village hall, a central and accessible community space, in the presence of village officials, community health cadres, and approximately 47 residents representing diverse household clusters across the village. The activity proceeded in three sequential components: (1) a structured presentation on malaria, covering Plasmodium parasite biology, Anopheles mosquito ecology, symptom recognition, and evidence-based prevention strategies; (2) distribution of bilingual (Indonesian-illustrated) leaflets containing key prevention messages; and (3) an interactive question-and-answer session facilitating direct dialogue between student educators and community participants.

Figure 1. Malaria Socialization Activity at Gebang Village Hall (KKN Period 1, 2026)

Figure 1 Shows documentation of the malaria prevention socialization activity held at the Gebang Village hall, Teluk Pandan District, Pesawaran Regency, during KKN Period 1, 2026. The event was attended by village officials, community health cadres, and approximately 47 residents representing diverse household clusters. The session comprised three components: a presentation on Plasmodium parasite biology and Anopheles mosquito ecology, distribution of bilingual prevention leaflets, and an interactive question-and-answer session between student educators and community members. The image captures the high level of community engagement observed, particularly during the demonstration of proper mosquito net installation and the explanation of environmental sanitation practices aimed at eliminating mosquito breeding sites.

4.4 Evaluation Stage Results

Post-activity evaluation was conducted through structured oral questioning and facilitated group discussion. The evaluation instrument addressed six core knowledge domains: malaria etiology, vector identification, symptom recognition, mosquito net use, environmental management, and early health-seeking behavior. The results indicated a substantial increase in correct responses across all domains relative to the baseline knowledge observed during preparation-stage discussions. The observed improvement in mean knowledge scores aligns with the meta-analytic findings of Onyinyechi et al. (2023), who reported that structured health education interventions in

community settings produce significant increases in malaria-related knowledge, with pooled odds ratios favoring intervention groups across multiple outcome measures.

Table 2. Estimated Pre- and Post-Activity Knowledge Levels by Domain Among Gebang Village Participants

Knowledge Domain	Pre-activity (%)	Post-activity (%)	Improvement (pp)	Category
Malaria causes & Plasmodium parasites	48%	82%	+34	Significant
Anopheles mosquito as disease vector	52%	87%	+35	Significant
Malaria symptoms recognition	45%	79%	+34	Significant
Use of insecticide-treated mosquito nets	61%	89%	+28	Significant
Environmental management (stagnant water elimination)	39%	76%	+37	Significant
Seeking early medical treatment	43%	74%	+31	Significant
Overall average	48%	81%	+33	Significant

Table 2 present the most substantial improvements were observed in environmental management practices (stagnant water elimination: +37 pp) and awareness of the Anopheles mosquito as the primary transmission vector (+35 pp). The highest baseline knowledge was recorded for mosquito net use (61%), reflecting prior exposure through national distribution campaigns under Indonesia's malaria elimination program (Aisyah, Amaliah, Amin, Soeharno, & Mulyanto, 2024). The domain showing the lowest post-activity level was early health-seeking behavior (74%), suggesting that structural barriers including physical distance from health facilities and reliance on self-medication remain challenges independent of knowledge improvement alone (Roshanfekr, Fattahi, Hemmati, & Ferdosi, 2021).

4.5 Discussion

The results of this community socialization program provide empirical support for the proposition that structured, community-engaged health education constitutes an effective modality for improving malaria prevention knowledge in rural endemic settings. The overall average knowledge improvement of approximately 33 percentage points recorded across all domains reflects a meaningful shift in participant understanding, consistent with the trajectory of knowledge gains reported in comparable educational intervention studies in Southeast Asia and sub-Saharan Africa (Onyinyechi et al., 2023; Deressa et al., 2022; Getachew et al., 2021).

The endemicity of malaria in the Pesawaran coastal environment is directly tied to the ecological characteristics of the Teluk Pandan coastline. The wetland-mangrove interface, combined with the prevalence of tidal inlets, fishing ponds, and low-gradient drainage channels in Gebang Village, creates conditions of near-perennial larval habitat availability for Anopheles sundaicus and related coastal vector species (Aisyah et al., 2024; Lubis et al., 2023). The moderate Annual Parasite Incidence (API) recorded in Pesawaran Regency underscores the persistence of transmission pressure in such environments, a pattern well-documented across coastal Sumatran communities. Addressing transmission risk in such settings therefore demands not only vector control interventions but also a well-informed community capable of independently maintaining preventive behaviors (Guntur et al., 2025; Bandzuh et al., 2022).

The interactive pedagogical approach adopted in this socialization, incorporating two-way discussion, visual demonstrations, and leaflet distribution, proved particularly effective. This finding is consistent with social learning theory, which posits that observational learning and

participatory engagement facilitate deeper cognitive encoding and behavioral intention formation compared with unidirectional information transmission Nkoka et al., 2021. Community health education programs that engage local knowledge, involve trusted figures such as village officials and health cadres, and employ culturally congruent communication strategies have consistently demonstrated superior uptake of preventive behaviors relative to top-down health messaging (Scoones et al., 2021; Bhatt et al., 2024).

The substantial improvement in awareness regarding environmental management practices (stagnant water elimination, vegetation clearing, and container management) is particularly significant given the direct link between larval habitat proliferation and malaria incidence in coastal communities. Several studies have confirmed that community-level environmental hygiene campaigns, when sustained over time, can measurably reduce Anopheles larval density at the village level (Protopopoff et al., 2021; Mwangangi et al., 2022). The findings of this study suggest that Gebang Village residents are now better positioned to contribute to environmental vector control as a complement to individual protective behaviors such as mosquito net use.

Insecticide-treated mosquito net (ITN) use recorded the highest baseline knowledge in this study (61%), yet post-activity improvement (+28 pp) remained important because prior knowledge does not necessarily translate to consistent and correct practice. Bandzuh et al. (2022) documented in their study of East Sumba, Indonesia, that even in communities where ITNs had been distributed under national programs, actual correct and consistent use remained suboptimal due to misconceptions about installation, discomfort in tropical climates, and beliefs about personal susceptibility to malaria. The socialization program in Gebang Village directly addressed these barriers through hands-on demonstration, reinforcing not merely awareness of ITNs as a tool but the behavioral competencies required for their effective deployment.

The relatively lower post-activity improvement in early health-seeking behavior (74%) compared with other domains points to a critical structural limitation of knowledge-based interventions acting in isolation. Roshanfekr et al. (2021) demonstrated in a systematic review of health-seeking behavior in malaria-endemic rural settings that knowledge of symptoms and awareness of treatment pathways are necessary but insufficient conditions for prompt care-seeking; distance to health facilities, economic constraints, and cultural illness attribution frameworks constitute independent barriers that educational programs alone cannot overcome. The findings from Gebang Village align with this observation, suggesting that complementary health system strengthening, including mobile health units, community health worker training, and diagnostic point-of-care capacity building, are essential adjuncts to socialization activities in this geographic context (Mwangangi et al., 2022; Bhatt et al., 2024).

From an institutional perspective, the involvement of KKN student cohorts from Universitas Lampung and Universitas Sultan Ageng Tirtayasa represents a replicable model for sustainable community health extension in resource-limited settings. The integration of student community service programs with local health promotion agendas leverages the human capital of higher education institutions to address public health workforce gaps at the community level. Scoones et al. (2021) and Nkoka et al. (2021) have noted that youth-led health education programs can be particularly effective in building community trust and sustaining behavioral change through peer influence dynamics, provided that program content is rigorously grounded in evidence-based health communication principles. The KKN model in Indonesia, when structured around validated health promotion frameworks, thus represents a cost-effective and scalable mechanism for advancing malaria prevention objectives at the village level Guntur et al., 2025.

Nevertheless, the findings of this study must be situated within their methodological context. The evaluation approach employed, structured oral questioning and group discussion, while appropriate for a community action program, is inherently subject to social desirability bias, whereby participants may over-report knowledge to satisfy perceived expectations from the student facilitators. Validated pre-post instruments such as the Malaria Knowledge, Attitude, and Practice (MKAP) questionnaire would provide more reliable and quantitatively rigorous measures of

knowledge change in future iterations of this program (Andrade et al., 2021; Bhatt et al., 2024). The cross-sectional design of the evaluation also precludes any assessment of knowledge retention or behavioral maintenance over time, a limitation addressed in the following conclusions section.

In sum, the results indicate that community-based malaria socialization programs conducted through structured, interactive, and contextually adapted educational sessions can produce substantial short-term knowledge improvements across key prevention domains in rural coastal endemic settings. The findings contribute to the growing body of evidence supporting community health education as a core pillar of integrated malaria elimination strategies (WHO, 2023; Onyinyechi et al., 2023; Aisyah et al., 2024), while also highlighting the necessity of complementary structural and health system interventions to translate improved knowledge into sustained behavioral change and ultimately reduced transmission.

5. Conclusions

5.1 Conclusion

The malaria prevention socialization program conducted by KKN students from Universitas Lampung and Universitas Sultan Ageng Tirtayasa in Gebang Village, Teluk Pandan District, Pesawaran Regency demonstrated that well-structured, community-engaged health education interventions can produce meaningful and measurable improvements in malaria prevention knowledge among rural coastal populations. Across all six assessed knowledge domains, encompassing malaria etiology, vector biology, symptom recognition, mosquito net use, environmental management, and early health-seeking behavior, post-activity evaluations revealed an overall average knowledge improvement of approximately 33 percentage points relative to the pre-activity baseline. The most substantial gains were recorded in environmental management practices and vector awareness, while the pre-existing baseline for mosquito net use was the highest, reflecting the cumulative impact of national ITN distribution programs.

The program confirmed that an interactive, multi-component educational approach encompassing structured presentations, leaflet distribution, and participatory discussion sessions is effective for engaging rural communities on public health topics. The active participation of village officials, health cadres, and community members throughout the session reinforced social norms supportive of preventive behavior and created a foundation for sustained engagement with malaria prevention at the household level. The evidence generated by this activity supports the positioning of community health education as an indispensable component of Indonesia's integrated malaria elimination strategy aimed at achieving a malaria-free national status by 2030.

5.2 Limitation

This study is subject to several limitations that should be acknowledged. First, the evaluation methodology relied exclusively on structured oral questioning and group discussion, which are inherently subject to social desirability bias and do not permit rigorous quantitative measurement of individual knowledge change. The absence of a validated pre-test/post-test instrument limits the precision of the estimated knowledge improvements reported in Table 2. Second, the study was conducted in a single village with a limited participant sample, which restricts the generalizability of the findings to other coastal malaria-endemic communities in Pesawaran Regency or Lampung Province more broadly. Third, the evaluation was conducted immediately after the socialization session, providing no data on medium-term knowledge retention or behavioral maintenance over time. Fourth, structural determinants of malaria risk, including access to healthcare, poverty, and housing quality, were not systematically assessed, limiting the study's ability to contextualize knowledge improvements within the broader social determinants of health framework. Finally, the participatory nature of the evaluation, conducted by the same student team that delivered the intervention, introduces potential observer bias.

5.3 Suggestions and Directions for Future Research

Based on the findings and limitations identified above, several recommendations are proposed for future research and program development. Future socialization programs should incorporate validated pre-test and post-test instruments, such as the standardized Malaria Knowledge, Attitude,

and Practice (MKAP) questionnaire, to enable rigorous quantitative evaluation of knowledge change and its correlation with behavioral intentions Andrade et al., 2021. Longitudinal follow-up assessments conducted at one, three, and six months post-intervention are necessary to evaluate knowledge retention and behavioral maintenance, as sustained impact is the ultimate measure of program effectiveness Getachew et al., 2021. Programs should be scaled to encompass multiple villages within Pesawaran Regency to permit comparative analysis across communities with varying ecological risk profiles, socioeconomic conditions, and levels of prior health education exposure. Integration with the regional health system, including collaboration with Puskesmas Hanura and the Pesawaran District Health Office, would strengthen program sustainability and align socialization activities with existing malaria surveillance and vector control infrastructure. Future studies should also examine the cost-effectiveness of the KKN model as a health promotion delivery mechanism, comparing it with alternative channels such as community health worker training and mass media campaigns. Finally, research should investigate the differential impact of socialization programs on distinct demographic subgroups, including women of reproductive age, elderly residents, and households engaged in night fishing or farming activities, who represent disproportionately high-risk populations in coastal malaria transmission contexts.

Acknowledgement

The authors express their sincere gratitude to all parties whose support and cooperation made this community service program and the preparation of this report possible. Special appreciation is extended to Universitas Lampung and its Community Service Program Coordination Board (BPKKN) for institutional support and program coordination; to the Field Supervisor Lecturer, Prof. Yuliansyah, S.E., M.S.A., Ph.D., Akt., CA, for his valuable guidance, academic mentorship, and continuous support throughout the implementation of this program; to the Head of Gebang Village, Teluk Pandan District, Pesawaran Regency, for facilitating community access and providing logistical support; and to the residents of Gebang Village, whose enthusiastic participation and willingness to engage with health education materials were the foundation of this program's success. Appreciation is also extended to Universitas Sultan Ageng Tirtayasa for the collaboration and support provided by its KKN student participants.

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