COLLABORATIVE MALARIA SURVEILLANCE ENDING OUTBREAK IN MERANGIN: EARLY RESPONSE BY ACADEMIA AND MUHAMMADIYAH COMMUNITY

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ABSTRACT

The Mass Blood Survey (MBS) conducted in August 2023 in Sungai Tebal Village, Jambi Province, in response to a malaria outbreak declared by the Regent of Merangin. The outbreak began with 52 confirmed malaria cases (50 Plasmodium vivax and 2 Plasmodium falciparum), indicating a substantial rise compared to previous years. The District Health Office, an academic institution, and community health partnered to carry out the MBS, which was launched six months after the index case. Prior to implementation, the team coordinated with local health authorities and community organization thus prepared for both rapid diagnostic testing (RDT) and public health education. A total of 33 individuals were tested, and all RDT results were negative, indicating no further local transmission. The findings underscored the importance of early detection, collaborative efforts, and sustained preventive strategies in malaria-endemic regions to avert future outbreaks.

Keywords: Active Surveillance, Malaria Elimination, Outbreak Response, Rural Health, Integrated Control

1. INTRODUCTION

Since 2020, several non-Papua districts in Indonesia have experienced local malaria outbreaks (KLB), often in areas previously considered low to moderate endemic. Notable examples include Rokan Hilir (Riau), with over 2,700 cases by 2023 linked to poor waste and water management (Zulfadli, 2025); Aceh Singkil, where malaria re-emerged in 2024 after being eliminated in 2017, likely due to reintroduction of the parasite and environmental factors (Pujo, 2025); and Pohuwato and Boalemo (Gorontalo), where gold mining activities and labor mobility were major drivers of transmission, with hundreds of cases reported in early 2025 (Azhar & Hardiyanto, 2025). Other KLBs occurred in Indragiri Hilir (Riau) (Saputra, 2024)and Tanimbar Islands (Maluku) (Editor, 2023), where stagnant water and delayed response worsened the situation. These outbreaks underline the role of environmental conditions, human mobility, and reintroduction of parasites as key contributors to malaria resurgence in districts that had been close to or achieved elimination status.

In Indonesia, a malaria outbreak is characterised by a notable epidemiological rise in malaria cases or fatalities within a designated region and timeframe, with technical criteria differing based on endemicity (Kemkes, 2017); even one indigenous case is sufficient to classify as a KLB in areas targeted for elimination. The Ministry of Health has established a structured response protocol requiring immediate reporting within 24 hours, an epidemiological investigation within two days, and intervention measures—including mass blood surveys, antimalarial treatment, and vector control—within five days (Kemkes, 2022). This response is to be coordinated with local authorities and supported by national agencies. The KLB classification may be elevated if no new cases emerge following two complete incubation periods, approximately 28 days, as indicated by epidemiological assessments conducted by health officials (Kemkes, 2023). Nonetheless, the removal of KLB status does not equate to the eradication of malaria, which necessitates three consecutive years without indigenous transmission and stringent surveillance (Septono, 2018). An area may continue to be classified as low-endemic if sporadic cases occur, as in Aceh Singkil Regency which must undergo requalification for malaria-free status despite the lifting of its prior KLB status (Aulia, 2025). The outbreaks in Pohuwato (2025) and Rokan Hilir (2024) exemplify a system characterised by initial investigation and intervention (Hab, 2025), subsequently supported by national resources and continuous monitoring (Kemkes, 2024).

2. PURPOSES

The mission was executed as an emergency public health response to a confirmed malaria outbreak (KLB) in the remote highlands of Merangin Regency, Jambi Province, Indonesia (see Figure 1). The mission occurred in Sungai Tebal Village (STB), that the 50 confirmed malaria cases of *Plasmodium vivax* and two cases of *Plasmodium falciparum* among village residents, marking a substantial increase compared to previous years, which reported no more than 10 cases.

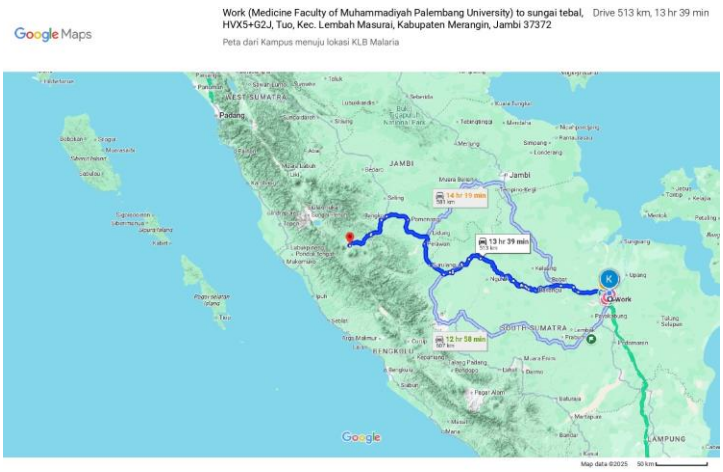

Figure 1. depicts a Google Maps map of the event site. The distance between the office of Faculty of Medicine Universitas Muhammadiyah Palembang and Sungai Tebal Hamlet Lembah Masurai District, Merangin Regency, Jambi is 513 kilometers

Malaria may resurface, despite the fact that the most recent survey found no evidence of local transmission. As a result, regular surveillance, at least once a month for a year following the epidemic, is essential to ensure that the region remains malaria-free and that any new cases are found immediately. However, limited human resources and logistics make it challenging to perform such complex monitoring through tough locations.

The initiative aimed to implement continuous surveillance through monthly monitoring for at least one year following the outbreak to detect any potential re-emergence of malaria, thereby maintaining the region's malaria-free status and preventing future outbreaks. The activity had to address challenges in effectively implementing surveillance, considering logistical and human resource limitations in remote highland regions. The mission also sought to assess the effectiveness of emergency malaria control measures in halting local transmission and improving readiness for potential future outbreaks in the region, ensuring no further local transmission occurs.

3. LITERATURE REVIEW

The endemicity of malaria in Indonesia varies across regions (Sukmawati et al., 2021). Malaria prevalence is notably high in East Nusa Tenggara, Papua, and West Papua, where both the API and slide positivity rates are elevated (Philothra et al., 2023)]. Conversely, malaria is rare in Western Sumatra and Java (Aisyah et al., 2024), although localized epidemics have been reported in areas such as Kokap Subdistrict, Yogyakarta Province (Murhandarwati et al., 2014). Nationally, malaria incidence increased by 62.63% from 2014 to 2022, even as prevalence declined in Sumatra and Kalimantan (Aisyah et al., 2024). Treatment-seeking behavior is a key challenge, as self-medication and reliance on traditional medicine can hinder and exacerbate malaria outcomes These behaviors are shaped by education, socioeconomic status, and geographic accessibility (Philothra et al., 2023). Effective malaria prevention requires the use of medication, insecticide-treated nets, and indoor residual spraying (IRS) (Lusiyana & Ahdika, 2022), while ongoing monitoring and culturally appropriate interventions are crucial for sustainable elimination (Natalia et al., 2025). *Plasmodium falciparum* and *Plasmodium vivax* are the dominant species in Indonesia; however, chloroquine resistance and frequent relapses make *P. vivax* a significant threat (Surjadjaja et al., 2016). Transmission occurs via *Anopheles* mosquitoes, notably *An. sundaicus, An. letifer,* and *An. barbirostris* (Kamigaki & Oshitani, 2015). Efforts to control malaria are further complicated by imported cases, particularly from neighboring countries (Sugiarto et al., 2022). Overall, Indonesia faces persistent challenges in malaria eradication, influenced by ecological, anthropological, and socioeconomic dynamics. While some areas have made progress, others remain highly endemic, necessitating coordinated strategies and strengthened surveillance to meet the 2030 elimination target (Natalia et al., 2025).

Current research indicates the necessity of implementing surveillance, control measures, and community engagement to monitor and manage mosquito populations during a malaria outbreak (Sikaala et al., 2014). Monitoring encompasses ongoing evaluations of mosquito populations, standardised sampling methods for both adults and larvae, and cost-effective, dependable community-based mosquito trapping programs (James

et al., 2014). The integration of environmental and epidemiological monitoring can facilitate the development of malaria early warning systems (Wimberly et al., 2014). Important vector management techniques encompass indoor residual spraying (IRS) utilising DDT, long-lasting insecticidal nets (LLINs), and larviciding with *Bacillus thuringiensis* var. israelensis (Fillinger et al., 2008). Chemical interventions such as space spraying and insect repellents effectively decrease mosquito contact (Naudon, 2024). Community engagement is essential, as it prepares health workers for surveillance and mobilises communities for larval source reduction. The distribution of repellents, educational materials, and municipal communication networks serve to inform the public regarding epidemic prevention (Filler et al., 2006).

This key question motivating this program is: What methods can be employed to assess the effectiveness of emergency malaria control strategies in halting local transmission and preventing future outbreaks?

4. METHOD

The Mass Blood Survey (MBS) was executed in three phases: preparation, implementation, and evaluation (Picture 1 and 2). During the preparation phase, the program team coordinated with multiple stakeholders to ensure proper authorization and logistical support. This involved formally reporting the planned MBS activity to the Merangin District Health Office and securing necessary approvals (Picture 3). Additionally, the team consulted with the village midwife, who serves as the primary liaison for public health logistics and reporting within the community (Picture 4). The Muhammadiyah Regional Leadership Board (PDM Merangin) was also approached to support the initiative, particularly in providing accommodation and mobilization assistance for field teams (Picture 5).

In the implementation phase, the team conducted Rapid Diagnostic Testing (RDT) for malaria using antigen-based kits on specific respondent. The sampling technique utilized data from the Puskesmas and the malaria control midwife to ensure the accuracy and relevance of the sample. Given the widespread distribution of the population across a large area, the sample was drawn from one RT or talang that had not yet undergone malaria outbreak monitoring. The sampling was conducted to ensure representativeness and to identify relevant cases without bias, thereby ensuring that the statistics accurately reflect the malaria situation in the region. The Rapid Test SD Malaria identifies Histidine-Rich Protein 2 (HRP2) for *Plasmodium falciparum* and pan-parasite *Plasmodium* lactate dehydrogenase (pLDH) for *P. vivax*, *P. malariae*, and *P. ovale* using the HRP2/pLDH combination. Trained health analysts from the community health centre (puskesmas) conducted each test in accordance with WHO and manufacturer requirements. All RDT kits were stored at 2-8°C prior to use to ensure reagent stability, as recommended. The MBS team also provided alcohol swabs, blood collection lancets, and 5-liter cardboard safety boxes for the disposal of sharps. The MBS team also facilitated public health education sessions with community members, emphasizing Clean and Healthy Living Behavior (PHBS). These educational efforts aimed to improve awareness about malaria transmission, prevention strategies, and the importance of seeking early treatment for febrile illnesses. The dual

approach of testing and education ensured both immediate disease surveillance and long-term behavioral change within the community.

The evaluation phase focused on analyzing test results and documenting operational outcomes. All RDT results were recorded and participants received counseling based on their outcomes. No positive cases were detected, confirming the absence of ongoing transmission at the time of the survey. The data was compiled for epidemiological review by the health authorities to support further decision-making and monitor follow-up interventions. The team recieved malaria chemoprophylaxis one week prior to and one week following the field activity, and employed mosquito repellent lotion during fieldwork.

Figure 2. Malaria outbreak devastated The Lembah Masurai Subdistrict scheduled for a year-long malaria Mass Blood Survey (MBS). The initiative was a coordinated between the Merangin District Health Office Malaria Program Officer (Mr. Nandi), the local health centre Malaria Program Officer (Ms. Eva), the Head of Lembah Masurai Health Centre (Mr. Jonefa), the local youth leaders (Mr. Dicki), and occasionally medical students from Universitas Muhammadiyah Palembang Faculty of Medicine. The MBS team needed eight motorcycles to get to sites in the terrain of Mount Masurai, allowing for remote implementation. Link video: https://youtu.be/aTcy4391rts?feature=shared

5. RESULTS AND DISCUSSION

The Mass Blood Survey (MBS) was conducted in August 2023 (Picture 4), approximately six months after the index case report, as a collaborative initiative with an academic institution. Out of an estimated village population of 8000 individuals (Diana, 2017), 33 volunteered, satisfied the criteria, and consented to testing. The activity comprised 19 males (58%) and 14 women (42%); the age distribution: thirty individuals (91%) were 24-59, while two (6%) were under 24 and two (6%) were above 59. The participants' educational backgrounds comprised 18 elementary school (SD) students/graduates, 6 junior high school (SMP) students, 5 senior high school (SMA) students, 2 vocational school (SMK) students, 1 diploma II (D2) holder, and 1 diploma III (D3) holder. The majority of volunteers, totalling 31, were

coffee farmers, while the remaining two were housewives. All 33 subjects in the Rapid Diagnostic Test (RDT) were determined to be free of malaria. This indicates that continuous monitoring and management measures maintained the community's malaria-free status for one year.

The lack of new malaria cases following the treated index case indicates that the outbreak was imported rather than transmitted locally. This indicates that prompt treatment, distribution of mosquito nets, and targeted indoor spraying, along with the reduction of mosquito breeding conditions, are effective measures. The absence of severe symptoms and the presence of limited malaria immunity indicate that significant local transmission did not occur.

Figure 3. Field health personnel collected Rapid Diagnostic Tests (RDT) blood samples in affected plantation villages using temporary tents. Fingertip capillary blood samples were obtained using a sterile lancet. A buffer solution was subsequently added following the addition of blood to the quick diagnostic test device. The test results were evaluated on-site within 15 to 20 minutes. Rapid field-based malaria detection, independent of laboratory facilities, renders RDTs valuable for emergency outbreaks and remote regions.

While optimistic, negative RDT results warrant caution, as RDTs are unable to identify low parasitemia or asymptomatic malaria infections. Subclinical cases with parasite count under 100 parasites/µL may go undetected, serving as reservoirs for transmission. Based on available resources, it may be advisable to conduct repeat screening after two weeks or perform PCR testing on selected samples. Serial microscopy is recommended in routine programs when clinical suspicion persists despite negative results; however, early rapid diagnostic tests are frequently utilised during outbreaks to facilitate prompt decision-making. The absence of new cases and the reduction in fever patterns suggest that the classification of the outbreak will be evaluated and potentially lifted if no transmission is confirmed within a specified timeframe.

Figure 4. MBS team payed a visit to the District Health Office to report and coordinate operations. drg. Sony Propesma, MPH, Head of the District Health Office; Mr. Nandi Arsy, Head of the Subdivision for Communicable Disease Prevention and Control; and Mr. Ronal all greeted the team heartily. The multisector collaboration in support of MBS programs, underlining the local government's commitment to integrated malaria control measures by distributing rapid diagnostic test kits and mosquito bed nets, particularly in malaria-infected coffee plantation areas.

Prior to the epidemic, the outbreak region exhibited high-endemic characteristics, with an API of 1.1 per 1,000 individuals, and had not eradicated malaria. An epidemic denotes a rapid escalation in malaria cases necessitating prompt intervention (KLB). The 52 cases in this context indicate a probable malaria outbreak. If screening results indicate no active indigenous transmission, it is probable that the index case was imported and addressed promptly (Chandra, 2024). An operational early warning system, encompassing case identification and field inquiry, is presented. The mobility of populations complicates the prevention of malaria reintroduction. Consequently, although the entirely negative result is promising, it should strengthen preventive measures.

Figure 5.The Mass Blood Survey (MBS) malaria response collaborated with frontline workers at the local health facility in Sungai Tebal (STB) Hamlet. Neti Puspitasari, a midwife, served as the principal liaison between the community and Puskesmas. Matters related to epidemic logistics and reporting: presenting essential information regarding the malaria outbreak; noting that numerous infected individuals from the remote coffee estates. The KLB malaria station functioned as a logistical hub.

Prevention and active surveillance are essential. Community-based malaria prevention can initiate in the absence of new cases. No current transmission was detected; however, the presence of *Anopheles* vectors in the area indicates potential resurgence if parasite sources are reintroduced. Therefore, the provision of free insecticide-treated nets for children and pregnant individuals, targeted fogging in the vicinity of index case residences and high-risk areas, along with community-driven elimination of mosquito breeding sites, should be sustained. Early intervention necessitates awareness of symptoms and timely pursuit of care; thus, public education remains essential. The Suku Anak Dalam community in Jambi Province is implementing a pilot program to train village health volunteers in basic early detection techniques utilising rapid diagnostic tests (RDTs) available at local health centres. This can be evaluated in Lembah Masurai to facilitate prompt assessment of febrile individuals. The Indonesian Ministry of Health supports community-based malaria agents (Juru Malaria Desa/JMD) to facilitate early detection and treatment in at-risk areas. In the malaria-free Purworejo District of Central Java, JMDs conduct screenings of returnees from endemic districts using rapid diagnostic tests (RDTs). If positive, treatment is initiated, and mass blood surveys are employed to trace contacts within three days. Migratory surveillance is essential in all malaria-free, importable regions.

Figure 6. The coordinators of the Mass Blood Survey (MBS) malaria project in Merangin Regency collaborated a visit with local leaders of Muhammadiyah. Drs. Saniman Sasmita, Chairman of the Muhammadiyah Regional Leadership (PDM) of Merangin, welcomed the group to the Secretariat Office located on Sapta Marga Street, IBRD Complex, Pematang Kandis Subdistrict, Bangko. This courtesy call acknowledged the essential support and involvement of Muhammadiyah leadership in the public health campaign and enhanced collaboration across sectors for malaria response by providing transportation, food, and accommodation; facilitating smoother field operations in addition to theological assistance.

6. CONCLUSION

A population screened with RDT in a malaria outbreak region (KLB) registered 33 conclusions. All RDT results were negative, signifying the absence of new malaria cases in the community. This indicated that local transmission was either prevented or did not take place, suggesting that the outbreak may have originated from a single imported case. Establishing the community's malaria-free status necessitated rapid mass screening. Prevention and active surveillance had to be sustained and enhanced. It was recommended to implement continuous community surveillance of febrile cases, conduct routine screening of coffee buyers from endemic areas, empower local health volunteers for early detection, and expand health education and vector control measures. These efforts were essential for sustaining malaria eradication achievements and preventing future outbreaks. Health officials, village leaders, community participants, academic institutions, and civil society organisations such as Muhammadiyah had to collaborate to eliminate malaria.

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