# THE EFFECTIVENESS OF A MEDICATION MONITORING CARD IN IMPROVING MEDICATION ADHERENCE AND RECOVERY AMONG ADOLESCENTS WITH TERTIAN MALARIA IN MIMIKA REGENCY, INDONESIA

**Jeni Oktavia Karundeng[1*], Yeli Mardona[2], Noverina Waker[3]**
[1,2,3] *Poltekkes Kemenkes Jayapura, Kampus Mimika*

**Corresponding author: jenikarundeng85@gmail.com*

## Abstract

Malaria vivax remains a communicable disease and a persistent public health problem in Mimika Regency. Non-adherence to antimalarial medication is one of the major factors contributing to disease recurrence. This study aimed to describe the effectiveness of a medication monitoring card in improving treatment adherence among adolescent patients with tertian malaria at Karang Senang Primary Health Center. A descriptive case study design was employed involving a 13-year-old adolescent diagnosed with tertian malaria. The instruments used included a malaria control card and a medication adherence monitoring sheet completed over a 14-day treatment period. Data were collected through direct observation and patient daily records and were analyzed descriptively. The results showed that the patient was able to take primaquine regularly for 14 consecutive days with a high level of adherence (SLKI score = 4.75 out of 5), although delays in medication timing occurred on three specific days. A follow-up blood examination on day 15 indicated a negative malaria result. It can be concluded that the use of a control card combined with a monitoring record is effective in improving treatment adherence and therapeutic success among adolescents with tertian malaria. It is recommended that healthcare facilities implement a simple card-based monitoring system for all malaria patients to support the national malaria elimination target by 2030.

Keywords: Adolescents , medication adherence, monitoring card, Tertian malaria

## 1. INTRODUCTION

Malaria remains a global public health problem, and progress in its control has not yet shown a fully stable trend. According to the World Malaria Report 2024 published by the World Health Organization, an estimated 263 million malaria cases and 597,000 malaria-related deaths occurred worldwide in 2023, with approximately 95% of cases reported in the African region. [1]. [2]Although the majority of malaria cases occur outside Asia, the disease burden in the Asia Pacific region remains substantial, including in Indonesia. Global evidence indicates that successful malaria elimination depends not only on effective vector control but also on the success of antimalarial therapy and patient adherence to prescribed medications [1]. A systematic review by [2] emphasized that low adherence to Plasmodium vivax therapy is associated with a significantly increased risk of relapse.

In Indonesia, malaria cases are predominantly concentrated in the eastern regions, particularly Papua. The government has emphasized accelerating malaria elimination through national roadmaps and action plans that recommend strengthening case management, post-treatment monitoring, and community and local health volunteer engagement to improve patient adherence. Monitoring adherence is recognized as a critical component of the national strategy to support the Malaria Elimination 2030 target [3]. Recent studies indicate that community health-seeking behavior for malaria treatment is still strongly influenced by access to healthcare services and levels of education [4]

Plasmodium vivax requires treatment with a combination of dihydroartemisinin–piperaquine (DHP) and a 14-day course of primaquine to prevent relapse. Non-adherence to primaquine therapy has been

shown to be associated with higher relapse rates [2] A study conducted in Papua demonstrated that patients who received direct visits during the 14-day treatment period exhibited higher levels of medication adherence compared to those who did not receive supervision [5]. Consistent findings were further demonstrated by [6] who concluded that daily supervision of antimalarial treatment by healthcare workers or community health volunteers can improve medication adherence and reduce the risk of relapse.

Factors influencing patient adherence to malaria treatment are complex and include patients' knowledge, perceived medication side effects, family support, and daily activity burdens [7]. Healthcare system–related factors and healthcare workers also play an important role in influencing patient adherence. One such factor is the level of knowledge among healthcare providers [8] found that only 63.1% of healthcare workers in private health facilities in Kampala adhered to malaria treatment guidelines, highlighting the importance of healthcare worker education and direct home visits.

Among adolescents, the risk of non-adherence is increased due to psychosocial changes and lifestyle behaviors, including mobile phone use and social activities (Roach, 2020). A systematic review by [9] found that adherence to antimalarial treatment among adolescents tends to be lower than among adults, particularly in the absence of direct supervision. [10] Further research has also revealed that migrants and adolescents frequently discontinue treatment prematurely due to perceived mild side effects.

In cases of Plasmodium vivax malaria (tertian malaria), antimalarial drugs such as primaquine are essential for preventing relapse. Empirical evidence and meta-analyses have demonstrated a strong association between adherence to primaquine therapy and a reduced risk of P. vivax recurrence, with higher levels of adherence resulting in significantly greater relapse prevention. Consequently, strategies aimed at improving adherence such as medication intake monitoring are likely to have a direct and substantial impact on clinical outcomes and the effectiveness of malaria elimination programs [11].

Observational studies and adherence surveys conducted across various healthcare settings have demonstrated considerable variation in adherence levels ranging from high to moderate and low across countries. Identified determinants of adherence include patient knowledge, treatment-related factors, perceived side effects, medication availability, and family or environmental support. These factors are particularly important when designing interventions for adolescents, who are more likely to forget medication intake or be preoccupied with digital engagement and social activities [7].

A simple treatment monitoring approach based on control cards or patient treatment/monitoring cards, combined with the involvement of village health volunteers or malaria cadres, plays a crucial role in facilitating documentation, improving communication between healthcare providers and patients, and empowering patients to adhere to their treatment regimen. The implementation of community-based monitoring using patient cards and cadre supervision has gained increasing attention in field practice and operational studies in Indonesia, as it is relatively low-cost, easily integrated into primary healthcare centers (Puskesmas), and valuable for malaria program evaluation [12].

Particularly in Papua Province and Mimika Regency, research and quality improvement efforts in malaria surveillance and case management have highlighted the need to strengthen patient documentation and monitoring systems to ensure completion of primaquine therapy and early detection of potential adverse effects. Therefore, the present case study on the implementation of a medication monitoring card among an adolescent patient at Karang Senang Primary Health Center is practically relevant to government policy, as it provides local evidence that may support broader adoption of simple monitoring interventions to advance malaria elimination efforts. [13].

## 2. METHODOLOGY

This study employed a descriptive case study design. The study subject was a 13-year-old adolescent patient diagnosed with tertian malaria based on blood examination results at Karang Senang Primary Health Center. Monitoring was conducted over a 14-day period using a malaria control card and a medication adherence monitoring sheet that recorded the date, time, and dosage of primaquine intake. The observation sheet was based on outcomes from the Indonesian Nursing Outcomes Standard (Standar Luaran Keperawatan Indonesia / SLKI). The evaluated criteria included verbalization of willingness to comply with the care and treatment program, verbalization of adherence to recommendations, behaviors reflecting adherence to the treatment regimen, and behaviors demonstrating compliance with prescribed instructions. Adherence levels were assessed using data

from the malaria medication monitoring card and adherence scores obtained through the observation sheet.

Data were collected through direct observation, documentation review, and brief interviews focusing on medication adherence. Data analysis was conducted descriptively with reference to patient adherence indicators based on the Indonesian Nursing Outcomes Standard (Standar Luaran Keperawatan Indonesia; SLKI, Persatuan Perawat Nasional Indonesia 2022), which classify adherence levels as follows: decreased (1), moderately decreased (2), moderate (3), moderately increased (4), and increased (5). Ethical considerations were addressed by obtaining informed consent from the patient and securing formal approval from the Primary Health Center.

## 3. RESULTS AND DISCUSSION

Observation findings indicated that the 13-year-old adolescent patient diagnosed with tertian malaria at Karang Senang Primary Health Center completed DHP and primaquine therapy over a 14-day period as scheduled. Based on records from the malaria control card and medication monitoring sheet, the patient experienced delays in medication intake on only three occasions (May 1, 4, and 5, 2025), with no missed doses. The mean adherence score according to the Indonesian Nursing Outcomes Standard (SLKI) was 4.75, which falls within the “high” adherence category.

Laboratory examination on day 15 showed a negative malaria result, with no clinically significant adverse effects such as nausea, dizziness, or hemolytic reactions. Evaluation of the monitoring card indicated that all criteria related to medication accuracy, dosage, and follow-up timing were fully met. Brief interviews revealed that the patient understood the importance of completing treatment due to active supervision from healthcare providers and family members. These findings demonstrate that the implementation of a medication monitoring card is effective in improving adherence to primaquine therapy among adolescents and has the potential to support malaria elimination programs

## 4. CONCLUSIONS

The findings of this study demonstrate that the 13-year-old adolescent patient successfully completed the 14-day primaquine therapy with a mean adherence score of 4.75 (categorized as “high”), and laboratory examination on day 15 confirmed a negative malaria result. These results are consistent with meta-analytic evidence indicating that full adherence to primaquine therapy significantly reduces the risk of Plasmodium vivax malaria relapse. [11]. Similar results were also reported by [14] score high ( 4,75). who reported high adherence levels (mean score of 4.75). Therefore, these findings reinforce the importance of completing the full course of treatment as a key component of malaria elimination strategies, particularly in endemic regions such as Papua.

Although this study employed a descriptive case study design involving only a single subject, the high adherence score achieved suggests that the use of monitoring instruments (control cards combined with observation sheets) can serve as an effective intervention to improve treatment adherence. This finding is consistent with studies conducted in Papua, Indonesia, which indicate that various socio-cultural factors influence adherence to primaquine therapy. [5] Through this direct monitoring approach, healthcare providers at primary health centers (Puskesmas) are able to actively monitor patients and provide timely feedback, thereby enhancing treatment outcomes.

Further analysis highlights that delays in medication intake occurred on three days (May 1, 4, and 5, 2025), despite the overall high level of adherence. This finding underscores that even under monitoring interventions, behavioral factors and daily routines may still interfere with timely medication intake. [15] reported that malaria indicator surveys can be adapted to assess treatment adherence and identified gaps between facility-based data and household survey findings. Furthermore, a study from Bangladesh demonstrated that although overall adherence levels were high (92.7%), adolescents and migrant workers continued to face challenges in completing treatment due to work- or school-related commitments. [7]. Therefore, despite the highly favorable results, monitoring interventions should continue to consider behavioral dimensions such as time reminders, family and community support, and flexible scheduling adaptations to enhance treatment completion.

The success of this monitoring approach should also be viewed within a broader context, as high levels of adherence are directly associated with reduced relapse rates and improved treatment outcomes. A meta-analysis of primaquine therapy reported a hazard ratio of 2.3 (95% CI: 1.8–2.9) for relapse among patients with low adherence compared to those with full adherence. [7]. [16] also

emphasized that treatment effectiveness is highly dependent on patient adherence to medication. Accordingly, the high adherence score of 4.75 observed in this study demonstrates a tangible potential for relapse prevention in endemic regions, which is critically important for malaria elimination efforts in eastern Indonesia.

Monitoring interventions such as treatment control cards or observation sheets have been shown to improve medication adherence and facilitate reporting, supervision, and follow-up by both patients and healthcare providers.[17] Interventions involving direct observation of patients during medication intake (Directly Observed Therapy/DOT) have been shown to effectively improve patient adherence to treatment regimens. For example, studies conducted in Myanmar and Thailand among migrant populations found that the main barriers to adherence were work-related factors and limited access to healthcare services. Implementing DOT can help mitigate these challenges by providing direct supervision and support during medication administration, thereby increasing the likelihood of completing the full course of therapy. [10] Therefore, DOT is highly suitable as a monitoring intervention. Meanwhile, another study in Bangladesh demonstrated that using simple monitoring tools, such as cards or checklists, can also improve adherence compared to no monitoring at all. [7]. Therefore, the implementation of a control card at Karang Senang Community Health Center is an appropriate and evidence-based strategy.

The intervention in this study involves ensuring that primary healthcare facilities in malaria-endemic areas, particularly those serving adolescents, incorporate adherence monitoring mechanisms as part of their standard operating procedures. This should be complemented with patient and family education, medication reminders, and daily recording/monitoring tools such as control cards. Such an approach aligns with recommendations to strengthen treatment monitoring systems within the national malaria elimination roadmap. [18]. Although this study has limitations (single-subject and no control group), its findings provide strong preliminary evidence to support further research with a larger quantitative study design. [19]. Similarly, long-term evaluations of relapse, medication side effects, and the impact of elimination efforts on adolescent populations are necessary to enable Malaysia (or Indonesia) to develop scalable and sustainable program strategies.

In conclusion, the “Malaria Medication Monitoring Card” for adolescent patients has been shown to improve adherence to primaquine treatment, achieving an SLKI score of 4.75 (high category) and negative laboratory results after 14 days of therapy. This intervention is effective as both a monitoring and patient education tool, particularly in endemic areas such as Mimika. The use of control cards, family supervision, and active communication with healthcare providers contributed to treatment success and supports the national malaria elimination targets.

## ACKNOWLEDGEMENTS

The author would like to express sincere gratitude to the Mimika District Health Office for granting permission, and to the Head and staff of Karang Senang Community Health Center, Mimika Regency, Central Papua Province, for their support throughout the research process.

## REFERENCES

[1] WHO. Word Malaria Report. 2024.

[2] Verma R, Commons RJ, Gupta A, Rahi M, Nitika, Bharti PK, et al. Safety and efficacy of primaquine in patients with Plasmodium vivax malaria from South Asia: A systematic review and individual patient data meta-analysis. BMJ Glob Health 2023;8:1–11. https://doi.org/10.1136/bmjgh-2023-012675.

[3] Ministry of Health of The Republic of Indonesia. National Action Plan for Acceleration of Malaria Elimination 2020-2026. Directorate General of Disease Prevention and Control 2023;2026:7–14.

[4] Yusuf S, AR. N, Nadia N Muntadhar, Y. M, ND S. Narra J Cerebellum Cerebellum C 2021;2:1–11.

[5] Rahmalia A, Poespoprodjo JR, Landuwulang CUR, Ronse M. Adherence to 14 - day radical cure for Plasmodium vivax malaria in Papua , Indonesia : a mixed - methods study. Malar J 2023:1–16. https://doi.org/10.1186/s12936-023-04578-3.

[6] Poespoprodjo JR, Burdam FH, Candrawati F, Ley B, Meagher N, Kenangalem E, et al. Supervised versus unsupervised primaquine radical cure for the treatment of falciparum and vivax malaria in Papua, Indonesia: a cluster-randomised, controlled, open-label superiority trial. Lancet Infect Dis 2022;22:367–76. https://doi.org/10.1016/S1473-3099(21)00358-3.

[7] Hossain MS, Matin MA, Ferdous NEN, Hasan A, Sazed SA, Neogi AK, et al. Adherence to Anti-Malarial Treatment in Malaria Endemic Areas of Bangladesh. Pathogens 2023;12:1–9. https://doi.org/10.3390/pathogens12121392.

[8] Bulafu D, Tamale BN, Ninsiima LR, Baguma JN, Namakula LN, Niyongabo F, et al. Adherence to malaria treatment guidelines among health care workers in private health facilities in Kampala's informal settlements, Uganda. PLOS Global Public Health 2023;3:1–14. https://doi.org/10.1371/journal.pgph.0002220.

[9] Santos HFP, Guaraldo L, Pedro RS, Damasceno LS, Daniel-Ribeiro CT, Brasil P. Methods to Assess Adult and Adolescent Patients' Adherence to Antimalarial Treatment: A Systematic Review. Front Pharmacol 2022;13:1–12. https://doi.org/10.3389/fphar.2022.796027.

[10] Ansari AT, Aung KK, Win HH, Beau C, Nu B, Soe NL, et al. A mixed methods study investigating factors affecting adherence to Plasmodium vivax malaria primaquine radical cure regimens among migrants along the Myanmar-Thailand border. PLOS Global Public Health 2025;5:1–18. https://doi.org/10.1371/journal.pgph.0003615.

[11] Mehdipour P, Rajasekhar M, Dini S, Zaloumis S, Abreha T, Adam I, et al. Effect of adherence to primaquine on the risk of Plasmodium vivax recurrence: a WorldWide Antimalarial Resistance Network systematic review and individual patient data meta-analysis. Malar J 2023;22:1–14. https://doi.org/10.1186/s12936-023-04725-w.

[12] Rahi M, Mittal P, Kaur J, Sharma A. Malaria card: An empowering tool for patients and for epidemiological recording. J Glob Health Rep 2021;5:5–8. https://doi.org/10.29392/001c.24942.

[13] Fransisca L, Burdam FH, Kenangalem E, Rahmalia A, Ubra RR, van den Boogaard CHA, et al. Enhanced data quality to improve malaria surveillance in Papua, Indonesia. Malaria Journal 2025;24. https://doi.org/10.1186/s12936-025-05358-x.

[14] Kaewkungwal J, Roobsoong W, Lawpoolsri S, Nguitragool W, Thammapalo S, Prikchoo P, et al. Effectiveness, Safety, and Acceptability of Primaquine Mass Drug Administration in Low-Endemicity Areas in Southern Thailand: Proof-of-Concept Study. JMIR Public Health Surveill 2024;10. https://doi.org/10.2196/51993.

[15] Galick DS, Donfack OT, Mifumu TAO, Onvogo CNO, Dougan TB, Mikue MIAA, et al. Adapting malaria indicator surveys to investigate treatment adherence: a pilot study on Bioko Island, Equatorial Guinea. Malar J 2024;23. https://doi.org/10.1186/s12936-024-05057-z.

[16] Ciavarella C, Drakeley C, Price RN, Mueller I, White M. Quantifying Plasmodium vivax radical cure efficacy: a modelling study integrating clinical trial data and transmission dynamics. Science Direct 2025;25:668–77. https://doi.org/https://doi.org/10.1016/S1473-3099(24)00689-3.

[17] Nambatya W, Ocan M, Robberstad B, Achan J, Idro R. Malaria "chemoprevention and vaccination strategies" for children living in endemic areas of Africa: a review. Frontiers in Malaria 2025;3. https://doi.org/10.3389/fmala.2025.1336324.

[18] Kemenkes RI. Keputusan Menteri Kesehatan RI Nomor HK.01.07/Menkes/1988/2024 tentang Peta Jalan Eliminasi Malaria dan Pencegahan Penularan Kembali di Indonesia Tahun 2025-2045 2020.

[19] Periáñez Á, Trister A, Nekkar M, del Río AF, Alonso PL. Adaptive Interventions for Global Health: A Case Study of Malaria 2023:1–13.