



Analysis of Malaria Risk Factors in Barus Village, Barus District, Central Tapanuli Regency in 2022

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ABSTRACT

Malaria is a serious health problem and can be fatal, especially in high-risk groups such as infants, young children, and pregnant women. Furthermore, malaria also causes anemia and reduces labor productivity. In 2010, approximately 65% of districts in Indonesia were malaria-endemic areas, and approximately 45% of the population in endemic areas was at risk of contracting malaria. In Batu Bara Regency, malaria cases have increased annually. This study aims to determine the risk factors for malaria. This study used a case-control design and was conducted in June 2022 in Batu Bara Regency, involving 170 respondents aged 12 years and above. Individuals with fever symptoms and a positive malaria test recorded at a health facility were cases, while controls were respondents with fever symptoms and a negative malaria test result. The variables studied were age, gender, occupation, nighttime habits, use of insecticide-treated bed nets, the presence of livestock pens, the presence of standing water, and the presence of fish ponds around the house, which were measured using a questionnaire. Multivariate analysis used logistic regression. The analysis results showed that age and the presence of livestock pens significantly influenced the incidence of malaria. Respondents aged 12-17 years had the highest risk of contracting malaria (AOR=3.85; 1.40-10.59) compared to the 18-40 age group (AOR=1.79; 0.70-4.58). Respondents who had a large pen near their residence were three times more likely to contract malaria than respondents who did not live near a pen (AOR=3.02; 1.02-8.92).

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1. Introduction

Malaria remains a global public health problem with high morbidity and mortality rates. (Tuesday, 2017), (Premiere, 2021) In 2021, there were approximately 247 million new cases of malaria recorded worldwide, with 619,000 deaths, of which 95% originated in African countries. (Anwar & Liberty, 2024), (Latif & Putri, 2023) In Indonesia, there were an estimated 811,636 new malaria cases and 1,412 deaths in the same year, with the majority of cases reported in Papua Province. The Indonesian government is targeting malaria elimination by 2030 through a national program, but transmission continues in various endemic areas. (Tiffani Putri & Darmawan, 2025), (Jarona, Purba, Purba, & KM, 2025).

North Sumatra Province is one of the areas with the highest malaria burden outside Papua.(N. Setiawan & Putri, nd),(Endriko, 2023)In 2016, this province ranked fifth in Indonesia for the highest number of malaria cases.(Yuliyanti, 2020),(Wahyuni & Miko Wahyono, 2024)Batu Bara Regency is an area with moderate endemicity (Annual Parasite Incidence >1 per 1,000 population) and shows an increasing trend in cases: 515 cases in 2020 (API 1.22), rising to 952 cases in 2021 (API 2.25), and 552 cases in January–September 2022 (API 1.28). These data indicate that malaria remains a serious health problem in this region.(Wahyuni & Miko Wahyono, 2024),(Ramadan, 2022).

Malaria transmission is influenced by various factors, including the host, the parasite, and the environment. Environmental factors such as the presence of stagnant water, ponds, and livestock pens have the potential to become breeding grounds for Anopheles mosquitoes, the malaria vector.(Ridjal & KM, 2024),(Adeliana, 2024). In addition, community behavioral factors, including nighttime habits and the use of insecticide-treated bed nets, also play a role in determining the risk of transmission. Given that malaria epidemiology is highly dependent on local conditions, risk factor analysis at the regional level is crucial for designing more targeted interventions.(Babba, 2007),(Tondok et al., nd).

2. Methods

2.1 Research Design

The research design used is quantitative research with an analytical observational approach.(Budi & Wijaya, 2020),(Ichsan, 2022)The research design used was a case-control study, in which researchers compared the case group, respondents diagnosed positive for malaria through laboratory testing, with the control group, respondents who had fever symptoms but tested negative for malaria. This study was conducted from June to December 2022 with a sample of 170 respondents, selected using a simple random sampling method.

2.2 Population and Sample

Target population: All residents of Batu Bara Regency aged ≥ 12 years. Cases: Malaria patients aged ≥ 12 years with positive microscopic or RDT results, symptoms, and visiting the community health center during the study period. Controls: Respondents aged ≥ 12 years with fever symptoms, negative malaria test results, and visiting the same community health center during the study period. Sample size: 170 people (85 cases, 85 controls). Sampling technique: Simple Random Sampling based on the Community Health Center laboratory register(RP Setiawan, 2016),(Ratodi, nd).

2.3 Data Collection Techniques and Instrument Development

Interviews were conducted using a research questionnaire. Additional data were obtained from malaria screening results at health facilities (community health centers).

2.4 Analysis Techniques

This research data analysis uses:

a. Univariate Analysis

Presents the frequency distribution and proportion of each variable (age, gender, occupation, behavior, environment, etc.).

b. Bivariate Analysis

Using multiple logistic regression to determine the dominant factors causing malaria, the results are in the form of an Adjusted Odds Ratio (AOR) with a 95% confidence interval (CI).

3. Results and Discussion

a. Respondent Characteristics

Total sample size: 170 people (85 cases, 85 controls). The majority of respondents were male. The largest age group was 18–40 years, but the 12–17 age group was at greatest risk of malaria. The most common occupations among the case group were students (40%) and fishermen (22.35%).

b. Bivariate Analysis Results

Age was significantly associated with malaria incidence ($p=0.005$). Those aged 12–17 years had a 4.42 times higher risk than those aged >40 years. Other variables such as gender, occupation, nighttime habits, mosquito net use, and the presence of stagnant water or ponds were not significantly associated.

c. Multivariate Analysis Results

Significant risk factors are: Age 12–17 years → Adjusted Odds Ratio (AOR) = 3.85 (95% CI: 1.40–10.59). The presence of a livestock pen near the house → AOR = 3.02 (95% CI: 1.02–8.92). Other factors do not have a significant effect.

3.1 Discussion

a. Age as a Risk Factor

Adolescents (12–17 years old) are at greatest risk of contracting malaria. This is thought to be due to their increased outdoor activity, both day and night, which increases the likelihood of exposure to Anopheles mosquito bites. This is consistent with research in Kenya and several regions in Indonesia, which shows that adolescents and young adults are more susceptible to malaria. (Kinansi, Mayasari, & Sitorus, 2021), (Kiik, Kep, & Kom, nd).

b. The existence of livestock pens

Respondents who had large livestock pens near their homes were three times more likely to contract malaria. Livestock pens can attract Anopheles mosquitoes by providing resting places or alternative blood sources, increasing mosquito density around homes. These results align with studies in Jepara and Lampung that found a strong association between livestock pens and an increased risk of malaria. (Hadi K, 2002), (Ruliansyah & Pradani, 2020).

c. Other Factors (Not Significant in This Study)

The habit of going out at night: no proven association, although other studies (Pangkalpinang) have found it to be risky. Use of mosquito nets: although theoretically protective, in this study it was not significant due to the very low level of use in both groups. Stagnant water and ponds: no significant association, possibly due to the different geographical conditions of Batu Bara compared to other coastal areas with more mosquito breeding sites. (Adriyani & Sujoso, 2019).

d. Public Health Implications

Malaria prevention should focus on adolescents and communities with livestock pens near their homes. Public education on mosquito bite prevention (using mosquito nets, ventilation wire mesh, and repellents) should be provided. Livestock pens should be located away from residential areas to reduce the risk of transmission. (Fatika, 2018).

4. Conclusions

Age, particularly the 12–17 age group, is at the highest risk of contracting malaria compared to adults and the elderly. This is related to adolescents' more frequent outdoor activities, making them more susceptible to mosquito bites. The presence of livestock pens near homes increases the likelihood of contact with malaria vectors by up to three times compared to homes without livestock pens.

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