The comparison of detection methods of asymptomatic malaria in hypoendemic areas

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Abstract. Malaria is still a problem that disrupts public health in North Sumatra. Late diagnosis will increase the chances of increased morbidity and mortality due to malaria. The early detection of asymptomatic malaria is one of the best efforts to reduce the transmission of the disease. Early detection is certainly must be done on suspect patients who have no malaria complaints. Passive Case Detection (PCD) methods seem hard to find asymptomatic malaria. This study was conducted to compare ACD (Active Case Detection) and PCD methods in asymptomatic malaria detection in the hypoendemic areas of malaria. ACD method is done by going to the sample based on secondary data. Meanwhile, PCD is done on samples that come to health services. Samples were taken randomly and diagnosis was confirmed by microscopic examination with 3% Giemsa staining, as gold standard of malaria diagnostics. There was a significant difference between ACD and PCD detection methods \( p = 0.034 \), where ACD method was seen superior in detecting malaria patients in all categories, such as: clinical malaria (65.2%), asymptomatic malaria (65.1%) and submicroscopic malaria (58.5%). ACD detection methods are superior in detecting malaria sufferers, especially asymptomatic malaria sufferers.

1. Introduction

Until now, one of the parasitic diseases that still being a concern to the world is malaria. Nearly 3.2 billion people live in malaria-endemic areas and have various risk factors. About 3.2 billion people live in malaria-endemic areas and have various risk factors. In 2015, 214 million new cases of malaria had been identified and more than 438,000 malaria patients have died\(^1\). In general, ages of infants, children under five and pregnant women have a high risk to suffer from this disease\(^2\).

Fluctuations in malaria cases are influenced by many factors. This condition can occur all the times in many places, including in North Sumatera Province\(^3\). One of them is the difficulty of detecting asymptomatic malaria. The delayed detection of asymptomatic malaria will increase the chances of gametocyte carrier formation and become a new source of malaria transmission\(^4\) and a decrease in control efforts\(^5\).

Detection of malaria patients is generally done by waiting for the suspect to come to the health service for examination and treatment. The method is often known as Passive Case Detection (PCD)\(^6,7\). This method will certainly be difficult to find asymptomatic malaria, which will not come to check up for having no complaint, especially fever\(^8\). To control the fluctuation of malaria cases, more active detection efforts are needed by approaching populations that have risk factors or those living in the vicinity of malaria sufferers, known as Active case detection (ACD)\(^9\). This method is expected to detect the presence of asymptomatic malaria, as an effort to reduce transmission of malaria transmission. This
study was conducted to compare ACD and PCD methods in asymptomatic malaria detection in the hypoendemic areas of malaria.

2. Methods
This study is part of a study that would make a diagnostic model of asymptomatic malaria patients in the hypoendemic malaria area, conducted from March 2015 to December 2018, in 4 primary health cares and 25 villages located in Batubara District, which is a hypoendemic area of malaria in the North Sumatera.

Each study subject was observed for 2 weeks and twice as long as the malaria period during the study period (longitudinal study). The sample of the study were residents who lived in the study area and had risk factors for malaria and were taken randomly.

ACD method is done by going to residents who live in the dwelling place of malaria patients (±200 meters), obtained from secondary data. Family members from selected home, will be sampled in the study. The home is randomly selected. Meanwhile, PCD is done on patients who come directly to health services. Samples were taken randomly. The size of the sample is not determined, but only based on the number of samples obtained during the study period.

Malaria diagnosis is made by performing microscopic examination as standard gold malaria diagnostic. Microscopic examination was performed by at least two trained microscopic individuals. Meanwhile, other characteristics were obtained through interviews and observation.

3. Result
The study was conducted on 2173 residents living in the study area. ACD detection method, involving more samples than PCD with the ages of 16-65 years in most of both. The knowledge possessed by the sample is generally lacking. Although in general, the neighborhood is good (table 1).

| Characteristic          | ACD |          | PCD |          |
|-------------------------|-----|----------|-----|----------|
|                         | n   | %        | n   | %        |
| **Ages**                |     |          |     |          |
| ≤ 5 years               | 68  | 58.1     | 49  | 41.9     |
| 6-15 years              | 662 | 68.2     | 309 | 31.8     |
| 16-65 years             | 723 | 68.0     | 341 | 32.0     |
| > 65 years              | 12  | 57.1     | 9   | 42.9     |
| **Knowledge**           |     |          |     |          |
| Good                    | 171 | 85.5     | 29  | 14.5     |
| Less                     | 1294| 65.6     | 679 | 34.4     |
| **Living Condition**    |     |          |     |          |
| Good                    | 1132| 68.7     | 516 | 31.3     |
| Worse                   | 333 | 63.4     | 192 | 36.6     |

Table 2 shows the analysis of 671 malaria patients obtained in this study. It is known that in all categories of malaria patients, most of them are found in ACD detection methods, such as clinical malaria (65.2%), asymptomatic malaria (65.1%) and submicroscopic malaria (58.5%). The same thing is found in malaria patients who have no fever (65.3%) and good category of knowledge (81%).
Meanwhile, bivariate analyzes that have been done showed asignificant difference between ACD and PCD detection methods, with p = 0.034, where ACD method seems superior (table 3).

**Table 3. Comparison of detection method.**

|                | ACD  | PCD  | p value |
|----------------|------|------|---------|
| Malaria (+)    | 431  | 240  | 0.034   |
| Malaria (-)    | 1034 | 468  |         |

4. Discussion

In fact, the amount examined on the ACD method must be more than the PCD. The same result was obtained in this study. Generally, in endemic areas, asymptomatic malaria patients are found in the ages of over 6 years. It also causes the largest number of ages that being examined in the ages of 16-65 years and 6-15 years.

Overall, the ACD method found more malaria cases (64.2%). Where 65.1% of them are asymptomatic malaria and 58.5% submicroscopic malaria. These results are consistent with the number of malaria patients who have no fever (65.3%). Stresman (2010) in this study also found more cases of asymptomatic malaria through ACD method.

The ACD method also seems to effectively reach people with a good level of knowledge. This shows the public awareness to voluntarily check themselves despite having no complaints to prevent and to reduce the transmission of this disease. The awareness of the residents would further decrease the chances of the formation of gametocyte carriers on the vector, considering the neighborhood where the majority of the population is categorized well.

Bivariate analysis showed significant differences in both methods, in which the ACD method was seen as more likely to find asymptomatic malaria cases compared with PCD method. The target area of ACD is the area reported to have malaria patients. The samples examined were the families of a house or residents in the vicinity of the detected malaria patients (second data). The same technique is also done by Lawpoolsri and Stresman in their studies. In fact, some studies have also restricted the area radius of the sample to be examined, to increase the efficiency of this method.

5. Conclusion

ACD detection methods are superior in detecting malaria patients, especially asymptomatic malaria sufferers. For the efficiency of the method, further analysis is needed for the boundaries of the sample area to be examined.
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