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Epidemiological Determinant of Malaria Incidents in Closed Community in Sub Distrik Namrole South Buru Regency Maluku Province

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Abstract

Malaria is a main health problem in islands, under-developed, and remote areas. Nationwide, Maluku in 2013 is listed as having 30.4% of Annual Malaria Incident (AMI) and 9.19% of Annual Parasite Incident. Meanwhile, South Buru Regency has Annual Malaria Incident of 14.49% and Annual Parasite Incident of 6.94%. The objective of this research is to understand the epidemiological determinant of malaria incidents in Kecamatan Namrole, South Buru Regency, Maluku Province. It's an observational research with a sample of 64 respondents for symptomatic and asymptomatic malaria. The employed instruments are Rapid Diagnostic Test (RDT) and microscopic gold standard. Examining malaria with RDT, three types of parasites are found i.e.: *P. falciparum*, *P. vivax*, and a mix between *P. falciparum* and *P. vivax*. Most parasitic species found is *P. falciparum*, 56.3%. RDT examination accuracy is proven with microscopic observation. It is suggested that RDT sensitivity value is 100% with 63.3% of specificity. Positive predictive value is 92.9% and the negative predictive value is 100% for positive likelihood ratio of 2.75% and negative likelihood ratio 0%. The degree of conformity (Kappa) between RDT and microscopic is 0. The advantage of RDT is that it can be used for fast diagnose of malaria. The advantage of Rapid Diagnostic Test (RDT) is that it can be used even in remote and isolated areas for early detection of malaria for the diagnostic purpose. RDT is very effective and efficient.

***Keywords*:** Epidemiological Determinant; Malaria Incidents.

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1. Introduction

In *The World Malaria Report*, World Health Organization (WHO) [1] states that based on the profiles and information from 99 countries in the world having transmitting malaria cases, there's an ongoing global progress in controlling and eliminating. 80 countries are in monitoring phase while 19 others are in malaria pre-eliminating phase. It's estimated that 3.3.billion people are at risk of malaria exposure. Even though, of all geographical areas, Africa has the highest risk of malaria infection, as much as 81% cases. It's also estimated that 91% of mortalities occur at children under 5 year, and the most severe is at pregnant women [2].

Global Malaria Programme (GMP) declares that malaria is a disease of which must be continuously observed, monitored, and evaluated and proper formulation of strategy and policy must be made. The data from Indonesian Ministry of Health in 2007 [3] suggests that most malaria sufferers in Indonesia are inhabitants of remote, difficult-to-reach areas. They live in poverty areas. During 1998 - 2003, there were Extraordinary Incidents (KLB) in 14 provinces, 26 regencies, 162 villages with 27.956 sufferers and 328 mortalities.

Malaria is a main problem in island areas, like Maluku and North Maluku islands. Nationwide, annual clinical malaria incidents (AMI) in Maluku from 1998-2013 can be considered high, i.e.: 23.9%, 54.6%, 48.4%, 22.3%, and 30.48% respectively. While Annual Parasite Incident (API) is reported to be as much as 11.4% (2008), 15.4% (2009), 12.3% (2010), 7.0% (2011), 10.4% (2012) and 9.19% (2013) of clinical malaria incidents for each 100 residents. Prevalence of malaria in South Buru Regency from 2009-2013 fluctuated, in 2008 the AMI is 14.492%, then 21.959% (2009), 9.886% (2010), 15.050% (2011), and 2.806% (2012). While the API in 2009 is 9.454%, followed by 6.808% (2010), 3.982% (2011), 5.982% (2012), and 6.492% (2013).

Results of previous researches show that until now there have been 14 strains of *P. falciparum* found worldwide, and this figure will keep increasing along with external changes as the trigger for genetic mutation. Besides, conception between male gametes and female gametes can also lead to recombination which will create new genetic variant. Apart from time-based difference, strain of *P. falciparum* infecting human in one place will be different from the one found in another place. According to research result conducted by [4], it's known that sensitivity and specificity value of microscopic is better than RDT in malaria examination for pregnant mothers.

Mobility or migration from malaria endemic areas to non-endemic areas, residents arriving and traveling during certain period of time (incubation period of Plasmodium), are potentially bringing about malaria infection transmission [5] Migration causes shifting in *P. falciparum*-infected population, especially children. Various reports mention that *Multiplicity of Infection* (MOI), will reflect infected individuals possess immunity against malaria [6, 7]

The objective of this research is to understand the epidemiological determinant of malaria incidents in sub district Namrole, South Buru Regency, Maluku Province.

2. Materials and Methods

Based on the types, this research is an observational research which is conducted in sub district Namrole, South

Buru Regency, Maluku Province. Samples of this research are 64 respondents having symptomatic and asymptomatic malaria. Instruments of the research are *Rapid Diagnostic Test (RDT)* and microscopic as *Gold Standard*. Data gathering technique is conducted by taking blood sample from all age level, which is the continued with blood examination to detect the presence of parasite species of *Plasmodium* by using *Rapid Diagnostic Test (RDT)* and microscopic as *Gold Standard* for sensitivity and specificity test.

3. Results

Table 1: Frequency of Distribution based on Age Groups (n = 64)

Respondent Ages	N	%
< 1 year old – 10 years old	39	60.9
11 – 20 years old	2	3.1
21 – 30 years old	9	14.1
31 – 40 years old	9	14.1
>40 years old	5	7.8

Table 2: Distribution of Identification Results of *Plasmodium Species* using RDT

Types of Parasites	N	%
P. Falciparum	36	56.3
P. vivax	14	21.9
Mix	7	10.9
Undetected	7	10.9
Total	**64**	**100**

Table 3: Distribution of Microscopic Observation Results as Gold Standard

Types of Parasites	N	%
Pf. Std Gametocytes	27	42.2
Pf. Std Ring	7	10.9
Pv. Std Tropozoid	10	15.7
Pv. Std Ring	2	3.1
Pf. Std Gametocytes + ring	7	10.9
Undetected	11	17.2
Total	**64**	**100**

Table 4: Distribution of Parasitemia based on Age Groups

Age Groups	P. Falciparum	*P. vivax*	Mix
< 1 year old – 10 years old	23	7	5
11 – 20 years old	0	0	0
21 – 30 years old	3	5	0
31 – 40 years old	5	1	1
>40 years old	5	1	1
Total	**36**	**14**	**7**

Table 5: Accuracy *Rapid Diagnostic Tes* (RDT)

	Microscopic (+)	Microscopic (-)	Total
RDT (+)	53	4	57
RDT (-)	0	7	7
Total	53	11	64

Sensitivity: 100%

specificity: 63%

Positive predictive value: 92.9%

Negative predictive value: 100%

Positive likelihood ratio: 2.75

Negative likelihood ratio: 0

Degree of conformity (Kappa) of RDT with microscopic: 0

4. Discussion

This research is a *cross sectional* diagnostic test which is conducted in Kecamatan Namrole, South Buru Regency, Maluku Province. Sample of the research are 64 people indicated as having malaria. Of those 64 respondents, 7 of whom are negative as per laboratory results. Most sufferers are at < 1 year old - 10 years old, 39 of whom, 60.9%, are having malaria. Children aged < 1 year old - 10 years old become most sufferers in this research. It's due to the adversity to environmental changes and lower immunity of children at that age

compared to those of adults. *Plasmodium falciparum* is the most found parasites in children, the number of children positively infected by *plasmoldium falciparum* is 23, 7 are positively infected by *plasmodium vivax* and 5 others are mixed.

Based on malaria examination using RDT, it's known that there are 3 types of parasites i.e. *P. falciparum, P. vivax* and mixed. Most detected parasites are *P. falciparum* 56.3%, followed by *P. vivax* 21.9% and mixed 10.9%. After proven with later examination, i.e.: Microscopic as *Gold Standard,* it's suggested that 4 examination results using RDT are untrue based on microscopic examination. Besides, there are 2 samples which are identified by RDT as *P. vivax* but later turn out to be *Plasmodium falciparum std. Gametocytes* after checked with microscopic examination.

In table 5, examination accuracy with *Rapid Diagnostic Test (RDT)* which is then proven with microscopic observation, it is suggested that by using 2x2 table the sensitivity value of RDT is 100% and the specificity is 63.3% for malaria early detection. Positive predictive value is 92.9% and the negative predictive value is 100% for positive likelihood ratio of 2.75% and negative likelihood ratio 0% . The degree of conformity (Kappa) between RDT and microscopic is 0.

This research is supported by [7]. Clinical malaria examination by using RDT compared to that of microscopic suggested that the sensitivity value is 98%, specificity is 100%, positive predictive value is 100%, and negative predictive value is 98%. Similar research is also supported by the research in [8] at Keruak Public Health Service, East Lombok Regency. It suggests that the sensitivity value is 100%, specificity 96.99%, positive predictive value 83.2%, and negative predictive value 100%. It's also suggested that RDT has good reliability on validity making it good instrument for diagnosing. Hence, RDT is recommended for early detection of malaria especially in remote and isolated areas compared to that of microscopic observation. *Rapid Diagnostic Test* (RDT) instruments' advantage is that it can quickly and easily detect plasmodium. RDT's disadvantage is that it can't be used to determine the number of parasites within blood [7, 9, 10].

5. Conclusion

The advantage of Rapid Diagnostic Test (RDT) is that it can be used even in remote and isolated areas for early detection of malaria for the diagnostic purpose. RDT is very effective and efficient when applied during Extraordinary Incidents (KLB).

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