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Research Article

Microscopic-Based Trend in Imported Malaria among Workers of Trenggalek District Returning from Kalimantan Island, Indonesia During 2012 – 2016

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ABSTRACT

Malaria in Indonesia remains a significant health problem. Trenggalek District is one of the receptive malaria areas in East Java Province, Indonesia, with mainly imported malaria from outside Java Island. The people of this district accustomed to traveling to outside Java where malaria is endemic for temporary working purposes. Usually, they have acquired malaria infection in the areas where they worked and brought to their homeland during their return to the district. The number of imported malaria cases depend on the returning season of the workers. When no workers return from outside Java malaria case is zero. During the year of 2012-2016 microscopic examination of Microscopic examination of Giemsa-stained thick blood films of the workers have been done in the working activity of Pandean Primary Health Center on their arrival from Kalimantan Island either by active or passive case detection. Microscopically positive data were reported herein to describe the trend of imported malaria in the studied areas. A total number of malaria-infected workers were 118 cases. The trend towards increasing case number yearly between 2012 and 2013 being 1.35%, then decreasing between 2013 and 2016 to only 4 cases in 2016. Different patterns of imported malaria by month were seen in each year but no specific pattern throughout the year. The *Plasmodium vivax* infection was predominant every year and followed by *Plasmodium falciparum* and mixed infection of those two species. Trends of imported malaria cases in Trenggalek district were decreased and increased irregularly in each month yearly. However, the number of cases declined annually during 2013 – 2016. Antimalarial prophylaxis and insecticides prevent the workers from malaria infection.

Keywords: Imported malaria, Trenggalek district, Pandean Primary Health Center

Introduction

Malaria is an infectious disease caused by protozoan of genus *Plasmodium*. This disease in human caused by *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae* and *Plasmodium ovale* [1]. A species of *Plasmodium knowlesi* that primarily caused malaria in primates, recently has been reported to infect human [2]. Malaria is transmitted by *Anopheles* mosquito from an infected person to others and affect mankind with the burden of disease [3]. In 2016, an estimated 216 million cases of malaria oc-

curred worldwide, compared with 211 million in 2015. Of the 91 countries reporting indigenous malaria cases [4]. On the other hand, imported malaria became a severe health problem in some nonendemic countries, such as China [5], UK [6], and Mediterranean countries [7]. In Indonesia, imported malaria cases have been reported from Jakarta [8] and Sukabumi District of West Java Province [9]. The importation of malaria to non-endemic areas has been reported to increase the risk of malaria reintroduction [5].

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Malaria is imported into a malaria-free area as a result of human migration. Thus, imported malaria is described as an infection that is acquired in an endemic area by an individual, but diagnosed in a malaria-free area either microscopically or clinically [10]. The length of time visit endemic countries varies among the nations [11]. WHO has classified malaria infection as imported based on three months period of visiting the endemic country [12], while other countries used different criteria [13, 14]. Malaria importation can be identified as four stages of people movement as described while people are in malaria eliminating region, during transit, in the endemic region, and upon return to the eliminating country. Some malaria interventions can be applied to each stage to prevent acquisition or transmission of imported malaria [12].

Trenggalek District is one of the hypo endemic malaria areas where malaria outbreaks have occurred during 2006, 2007 and 2008. Dongko subdistrict is one of the malaria endemic areas among five subdistricts in Trenggalek district those remains endemic [15]. Malaria cases in this subdistrict were contributed with imported cases. The people of Trenggalek District accustomed to transmigrate to outside Java Island, where malaria is endemic, for temporary working purposes [16]. Usually, they have acquired malaria infection during their stay in those areas and brought back to their homeland as demonstrated by the data recorded by Pandean Primary Health Center (PHC) in Dongko subdistrict, Trenggalek district, East Java Province during a period 2012 to 2016. This report described a data of imported malaria brought by labor workers returning from temporary working in Kalimantan Island, Indonesia, who have checked their blood films on their arrival.

Material and Methods

Location

Trenggalek is a district located in the southern part of East Java Province. This district is located at coordinates 111°24' up to 112°11' east longitude and 7°63' until 8°34' south latitude. Trenggalek mainly composed of mountainous land with an area covering $\frac{2}{3}$ of the total area. As for the rest of this ($\frac{1}{3}$) is a low-lying land. The height of land is between 0 and 690 meters above sea level. Pacitan and Ponorogo Districts border

Trenggalek District to the West, Ponorogo and Tulungagung Districts to the North, Tulungagung Regency to the East, and Indonesian Ocean to the South [17].

Data collection

The data of microscopic examination of imported malaria collected by Pandean PHC over period 2012 – 2016 including other characteristic and information of patients. The data were obtained from villagers who diagnosed microscopically infected with malaria upon their arrival from three months temporary working in Kalimantan Island. Microscopic examinations were done by the trusted analyst on Giemsa-stained blood films taken by finger-prick.

Results and Discussion

Number of cases

A total number of imported malaria cases in Pandean PHC throughout 2012-2016 were 118 cases consisted of 34 (28.81%), 46 (38.98%), 26 (22.03%), 8 (6.78%) and 4 (4.40%) cases respectively. The trend is increased from 2012 to 2013 but decreased yearly from 2013 to the lowest number in 2016. During 2012 a villager was reported suspected autochthonous malaria with fever. However, no parasite was found on his blood film by microscopic examination. Following this case, malaria cases in Pandean PHC were always imported cases [18].

Characteristic of patients

All patients were male workers and mostly were a productive group of ages, they were between 18 to 60 years old. Most patients were on 20 – 30 years old (54.24%). The youngest patients were one person of 18 years old and two persons were 19 years old in 2013. The oldest patient was one person of 60 years old and also found in 2013 (Table 1).

Origins of cases

All the patients have traveled to Kalimantan Island mainly to the provinces of East Kalimantan (Berau District, Sepaku Subdistrict), Central Kalimantan and South Kalimantan provinces. Main jobs were laborer of palm oil plantation (*Elaeis guineensis*), the plant that is used in commercial agriculture in the production of palm oil. The social and economic factors apparently

caused the temporary transmigration of Trenggalek's people outside Java Island to earn more income. One reason

Table 1. Number (%) of imported malaria patients based on group of age

Age (years)	Total (%)					Grand Total (%)
	2012	2013	2014	2015	2016	
18-19	0 (0)	3 (2.54)	0 (0)	0 (0)	0 (0)	3 (2.54)
20-30	13 (11.01)	29 (24.58)	16 (13.56)	4 (3.39)	2 (1.69)	64 (54.24)
31-40	13 (11.01)	7 (5.03)	9 (7.63)	2 (1.69)	2 (1.69)	33 (27.97)
41-50	7 (5.03)	5 (4.24)	0 (0)	1 (0.85)	0 (0)	13 (11.02)
51-60	1 (0.85)	2 (1.69)	1 (0.85)	1 (0.85)	0 (0)	5 (4.24)
Total (%)	34 (28.81)	46 (38.98)	26 (22.03)	8 (6.78)	4 (3.39)	118 (100)

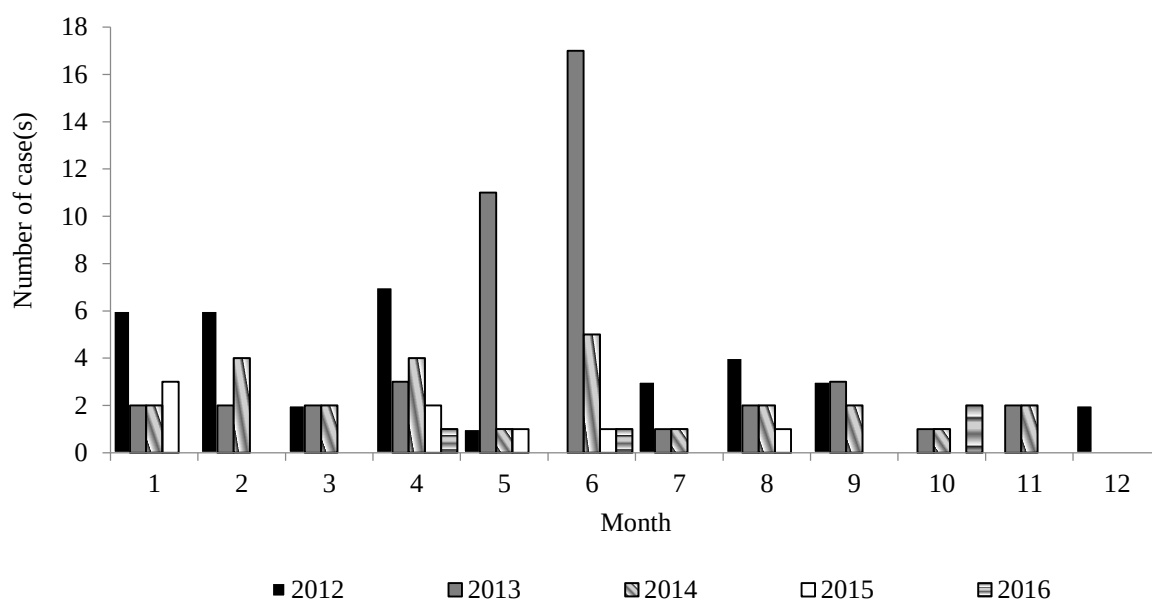


Figure 1. Monthly trend of imported malaria cases in former migrant workers in Pandean PHC during 2012 – 2016 respectively

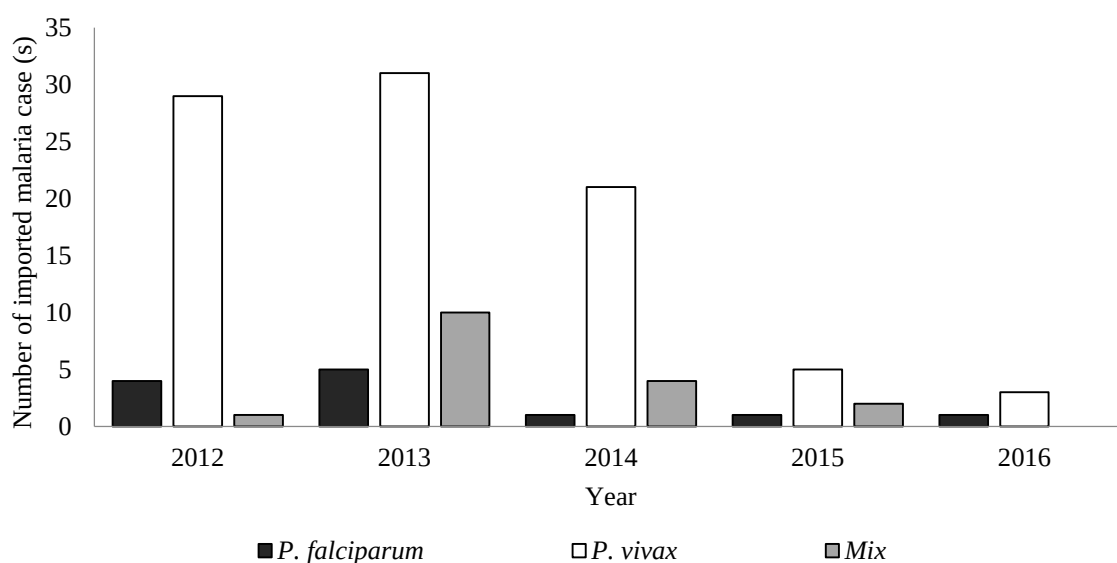


Figure 2. Number of imported malaria cases by species among former migrant workers reported by Pandean²⁰¹⁹ PHC in each year of 2012 – 2016

for their transmigration is that the employment opportunities in their villages are minimal. Unfortunately, it is followed by the increased of malaria infection brought by them during their return home. The factors associated with people movement include economic necessity, poverty, civil conflict and natural disasters [19, 20] contribute to the increase of malaria importation [21].

Monthly trends of imported malaria

The trend of imported malaria in Pandean PHC by month in each year showed that there was no specific pattern of imported malaria each month throughout the year. Monthly total number of imported malaria increased and decreases irregularly. Peaks occurred differently over each year. During 2012 peaks occurred in April, 2013 in May and June, and 2014 in June only. Zero cases were found in June, October and November of 2012, and December of 2013 and 2014, respectively (Figure 1).

The highest number of imported malaria in June may be related to the effort to earn more income to meet the expense of the new academic year of school entrance for their children. The importations of malaria were low during Muslim holiday vacation in August/October 2012-2014, probably caused by the decreased demand of workers in their working areas. The pattern of imported malaria in Pandean PHC is different from that in Jakarta, the capital city of Indonesia. The high peak of imported malaria in Jakarta occurred during school vacation and Muslim holidays vacation (Iedul Fitr) in June/July [8]. Fluctuation of imported malaria cases in Pandean PHC is seasonally depending upon the season where the workers return from outside Java to their homeland. However, due to better prevention of infection, since 2015 the number of cases decreased sharply. The number of Trenggalek's people and the schedule for their departure are uncertain. Therefore, there is no specific pattern of imported malaria cases fluctuation in Pandean PHC. The figure of imported malaria in Indonesia is different as reported in Jakarta⁸ and Sukabumi District [9]. In Jakarta, the capital of Indonesia, the imported malaria was reported among active duty military and civilian after traveling to Papua Province and South Sumatra (Bangka Island and Lampung Province) Indonesia [8]. The

imported malaria in Sukabumi District of West Java Province were reported majority from the people who worked in the mining sector those mostly working in night shift in Sumatra Island, Sulawesi, Nusa Tenggara and Papua. This particular group of travelers are the high risk of infection due to the activities in malaria endemic areas are often resulted in imported malaria cases [9]. Population mobility to outside Java Island and *vice versa* contributed to the complexities of risk of malaria infection in Indonesian archipelago.

Microscopic examination

Microscopic examination of total 118 blood films showed that *P. vivax* was predominantly found in each year. Total *P. vivax*-containing blood films were 89 (75.42%). They were 29 (24.57%), 31 (26.27%), 21 (17.80%), 5 (4.24%) and 3 (2.54%) since 2012 to 2016 respectively. Secondly was *P. falciparum* infection, those were 12 (10.17%) consisted of 4 (3.39%), 5 (4.24%), 1 (0.85%), 1 (0.85%) and 1 (0.85%) and followed by mix infection were 21 (17.80%) those containing of 1 (0.85%), 10 (8.47%), 4 (3.39%), 2 (1.69%) dan 4 (3.39%) during 2012-2016 respectively (Figure 2).

The workers returning from Kalimantan Island mostly were infected with *P. vivax* (Figure 2). Eastern parts of Indonesia are more common stable transmission zones of *P. vivax* than western parts [22], although *P. falciparum* is also common in Kalimantan Island [23]. The *P. vivax* infection in Kalimantan Island based on annual parasite incidence (API) are between < 0.1 to ≥ 0.1 ‰ depend on the provinces [22]. Large areas of malaria *vivax* transmission were found in most areas of Kalimantan and Sumatra Islands with a low level of endemicity than eastern regions of Indonesia [24].

The imported malaria cases in the People Republic of China were also reported in the labourers returning from Africa and South East Asian countries [25]. In the UK, the cases were reported among people who travel to visit friends and relatives to West African countries [6]. These groups of travelers constitute are at the high risk for importing malaria [25].

Activities involving population or individual movement to and from endemic malaria areas contributed to the spread [26], importation [27], and transmission [28, 20] of the disease, may also

reintroduce the disease to endemic and non-endemic areas [11]. The imported malaria often results in delays in diagnosis, expensive to treat, cause secondary local transmission and may contribute to the spread of antimalarial drug resistance and threaten long-term eradication goals [29]. Imported malaria caused not only the differences in the epidemiology of the disease but also clinical severity of malaria between both zones, ecological characteristic, circulating malaria parasites and population characteristic [21]. The Imported malaria should be addressed to achieve malaria elimination [12]. Trenggalek District as a receptive area with the existence of anopheline mosquito and other ecological and climate factors that favoring malaria transmission need to reduce receptivity by the use of insecticides such as larvicide, adulticide and repellent. Furthermore, asymptomatic malaria cases have been discovered [16] and in 2016 submicroscopic malaria cases have been proved play a role in malaria transmission in this area [30] however, in 2017 no indigenous malaria transmission has been reported [31].

Recently, the Pandean PHC has provided a malaria chemoprophylaxis drug to the workers before leaving for endemic areas to prevent the importation of malaria. The workers were given doxycycline at a dose of 2 mg/kg body weight for four weeks, more than that they were recommended to use insecticides or repellent to avoid mosquito bites especially at night. Following this intervention, elimination malaria has been achieved by Trenggalek District in 2017 since no indigenous malaria has been found [32].

Conclusion

The trends of imported malaria in Trenggalek district depend on the fluctuation of returning migrant workers from outside Java. In addressing imported malaria to maintain the free malaria area of this district, the chemoprophylaxis should be provided by the health center to the villagers before transmigrating to endemic areas in outside Java Island. The workers may also use insecticide or bednet to prevent mosquito bites during their stay in malarious areas. On the other hand, the microscopic examination of their blood should always be performed upon their arrival in their homeland.

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