

Perceptions and prevention practices on malaria among the indigenous Orang Asli community in Kelantan, Peninsular Malaysia

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Research

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Abstract

Background

Malaysia is on track towards malaria elimination. However, several cases of malaria still occur in the country. Contributing factors and communal aspects have noteworthy effects on any malaria elimination activities. Thus, assessing the community's knowledge, attitudes and practices (KAP) towards malaria is essential. This study was performed to evaluate KAP regarding malaria among the indigenous people (i.e. Orang Asli) in Peninsular Malaysia.

Methods

A household-based cross-sectional study was conducted in five remote villages (clusters) of Orang Asli located in the State of Kelantan, a central region of the country. Communities aged 6 years and above were interviewed. Demographic, socio-economic and KAP data on malaria were collected using a structured questionnaire and analysed using descriptive statistics.

Results

Overall, 536 individuals from 208 households were interviewed. Household indoor residual spraying (IRS) coverage and bednet ownership were 100% and 89.2%, respectively. A majority of respondents used mosquito bed nets every night (95.1%), but only 50.2% aware of bednets were use to prevent malaria. Nevertheless, almost all of the respondents (97.9%) were aware that malaria is transmitted by mosquitoes. Regarding practice for managing malaria, the most common practice adopted by the respondents was seeking treatment at the health facilities (70.9%), followed by self-purchase of medication from a local shop (12.7%), seeking treatment from a traditional healer (10.5%) and self-healing (5.9%). Concerning potential zoonotic malaria, about half of the respondents (47.2%) reported seeing monkeys from their house and 20.1% reported entering nearby forests within the last six months.

Conclusion

We conclude that most populations living in the villages have an acceptable level of knowledge and awareness about malaria. However, positive attitudes and practices with respect to managing malaria require marked improvement.

Introduction

Malaria, a febrile illness affecting people of all age groups, is a life-threatening parasitic disease with high morbidity and mortality worldwide. Approximately 230 million people are affected by malaria resulting in the deaths of 405,000 people globally in 2019 (1). In Malaysia, significant progress towards

the national elimination programme on human-only malaria has resulted in zero indigenous *Plasmodium falciparum* or *Plasmodium vivax* infections in 2018 (2). Malaysia is among the 21 countries of the WHO E2020 group that are earmarked as ready for malaria elimination in 2020 (3). Despite the success, within rural communities of Malaysia, the emergence of zoonotic transmission of the monkey malaria *Plasmodium knowlesi* has been less tractable to conventional malaria control and elimination programme (4). Nevertheless, the Malaysian government has reemphasized a great focus on malaria transmission foci at a local level as well as community understanding of malaria in order to achieve the elimination goal including the implementation of effective intervention strategies especially in remote communities of indigenous and tribal populations.

Orang Asli, the indigenous minority peoples of Peninsular Malaysia, comprises of three main tribes (i.e. Negrito, Senoi and Proto-Malay) with at least 18 distinct cultural-linguistic sub-tribes. They make up 0.6% of the total Malaysian population (5), with the Senoi tribe being the largest ethnic group constituting 55% of the total Orang Asli population with a large majority from the Temiar sub-tribe (Malaysia Department of Orang Asli). Since independence, the government of Malaysia has introduced various socioeconomic development programmes to improve the quality of life of the Orang Asli such as village resettlement, provision of electricity and water supply, construction of rural roads as well as easier access to education. Despite these proactive actions by the government, 37% of 869 Orang Asli villages throughout the country are still located in the remote and forested areas (6). Poverty and remote settlements exacerbate the health problems faced by these communities which include malnourishment and high incidences of infectious diseases including malaria (7–10).

In the past decade, studies conducted in Peninsular Malaysia have shown that malaria is common among the indigenous community of Orang Asli (9,10). This may be due to the low awareness or unreceptive behaviour among the Orang Asli towards malaria disease that might cause a lack of control activities involvement. Therefore, it is crucial to inform the whole communities to continue or adopt preventive behaviours that can reduce the risk of infections (11). Thus, this study aimed to evaluate the knowledge, attitudes and practices (KAP) regarding malaria among the Orang Asli, as they are one of the most vulnerable population to malaria in Peninsular Malaysia. To the best of our knowledge, this is the first study on KAP regarding malaria conducted in this community since the country declared zero indigenous malaria cases in 2018. The KAP identified could be used as baseline data to evaluate future tools and strategies formulated to control and/or eradicate malaria in the study area and other similar settings.

Methods

Ethics consideration

The study was approved by the Medical Ethics Committee of the National University of Malaysia (UKM PPI/111/8/JEP-2019-148) and the Department of Orang Asli Development or locally known as the Jabatan Kemajuan Orang Asli (JAKOA), Ministry of Rural and Regional Development Malaysia.

Respondent was adequately sensitized to the study objectives and procedures by the local health district personnel for the study participation.

Study sites

The study was conducted in Pos Kuala Betis (latitude 4°53'22"N; longitude 101°45'30"E), a cluster of five villages (Angkek, Betak, Sri Galas, Lambok and Podek) located at the Gua Musang district, Kelantan state, Peninsular Malaysia (Figure 1). The Temiar sub-tribe of the Senoi tribe was known to be the main indigenous Orang Asli in these villages. Located approximately 40km from Gua Musang town, the typical climate of the study area is tropical monsoon with temperature ranged between 20°C to 32°C and average annual rainfall between 2,000 mm to 4,000 mm. The district has a consistent humidity of around 82% to 86%. All villages shared common environmental factors including adjacent to the river-basin and forest-fringe villages. While the main economic activity was centred on agriculture such as palm oil plantation, the livelihood of the villagers mainly depended on rubber-tapping, labourers, farmers and gathering and selling forest products (12).

Entomological survey conducted by the District Health Office of Gua Musang in August 2018 identified *Anopheles maculatus* as the main potential malaria vector, although all mosquitoes caught were negative for *Plasmodium* oocyst by quantitative PCR (Ministry of Health, unpublished data). It has also been reported that this locality experienced recurrent malaria outbreaks within the past few years, which possibly related to autochthonous outbreaks of vivax malaria in the neighbouring state, Perak (7).

Study design and data collection

The household-based cross-sectional study was carried out between June and July 2019. All villagers aged 6 years old and above were invited to take part in the study. Participants were explained about the study protocol and consent was documented. For illiterate participant, consent was obtained in the presence of an independent literate witness. For children and adolescents below 18 years old, consent was obtained from parents or legal guardians. District healthcare providers and community leaders (i.e. Tok Batin) were purposely involved in the study to facilitate participation and cooperation among the community. Participants were divided into three groups in accordance with age stratification practices of the JAKOA i.e. school-going children (6 – 18 years), young adults (19 – 40 years) and older adults (>40 years).

A structured questionnaire was developed and administered to each households and residents within the village cluster to gather information concerning demographic, socio-economics, knowledge, attitudes and prevention practices on malaria. A pre-tested and validated pilot survey was conducted at communities from other districts to evaluate the clarity, adequacy and understandability of the questionnaire. Furthermore, preliminary interviews were also performed to ensure standard interviewers method, knowledge, and suitable interview questions usage. The interview was conducted face-to-face using Malay language or local dialect and all questions were open-ended. A knowledge score was calculated according to correct answers.

Data analysis

The data collected were tabulated into a spreadsheet of Excel (Microsoft, USA). Data analysis was performed using Stata/SE 13.1 for Windows (Stata Corp, USA). For categorical variables, data were presented as frequencies and percentages, while for continuous variables data were presented as mean \pm standard deviation (SD). The differences between respondent's characteristics were analysed using Chi-squared or Fisher's exact tests. *P*-values of ≤ 0.05 were considered statistically significant.

Results

Characteristics of respondents, households and malaria control measures

A total of 536 respondents and 208 households from Pos Kuala betis were participated in this study (Table 1). Of the overall population ($n = 941$) based on the Demographic Surveillance System database of the local district health office, only 57% ($n = 536$) individuals from 208 households responded. The surveillance coverage varied among villages from 42% to 72%, being mostly female (60.3%) and age of respondents ranged between 6 to 88 years old (mean [SD] age of 26.4 [17.1] years). Villagers from Angkek responded well in this study (72%) with a fair gender ratio distribution compared to other villages. Majority of the respondents were housewives (35.6%) and worked in the village (79.2%). Of the 208 surveyed households, most houses were constructed with wooden materials, such as walls (46.6%) and floors (7.1%), with corrugated iron roofs (91.8%).

With regard to malaria control measures, there was a remarkable overall ownership of the long-lasting insecticidal treated net (LLIN) (89.2%) and compliance for nightly usage in the community (95.2%) (Table 1). Furthermore, indoor residual spraying (IRS) was successfully administered by the health authority at least once during 2019 with 100% coverage in all surveyed households.

Awareness of malaria and the prevention practices

Table 2 shows the age-stratification of respondents' knowledge, attitudes and practices towards malaria. Overall, respondents from the age group of 19 – 40 years old responded well with regards to the basic knowledge on malaria compared to other age groups ($P < 0.0001$). Slightly half of the total respondents were aware on the causes of malaria (51.9%) and able to identify the common symptoms (50.7%). Although many of them could relate fever with malaria (40.6%), only a small proportions were able to determine rigor and chills as malaria symptoms (14.1%).

Almost all respondents (98.6%) acknowledged mosquitoes as the main cause of malaria transmission. However, only 53.5% of them have adequate knowledge on the malaria preventive measures with significantly higher ($P < 0.0001$) in 19 – 40 years group than their counterparts. Respondents from all age groups also agreed that the use of bed nets would be the best measure to prevent malaria (50.2%), however, the observations between age groups were not significant. Furthermore, a slight majority (52.2%) of the respondents reported knew on the practice of managing illness especially among the older age

groups ($P<0.0001$). The respondents also showed a remarkable action on seeking treatment at the government clinics (70.9%). Only a small proportion were still considered alternative treatment, such as practising traditional medicine (10.4%).

Contributing factors of zoonotic malaria transmission

Almost all respondents (94.8%; Table 3) in all villages reported to spend the nights at home ($P=0.0014$). Furthermore, almost half of the respondents (47.2%) mentioned that they have seen monkeys within 500m from their houses. However, most of this observation were reported by villagers from Sri Galas and Lambok ($P<0.0001$). In contrast, although the villages are located near to a forested area, only 20% of the respondents had entered the nearby forest within the last 6 months, especially respondents from Angkek compared to other villages ($P<0.0001$).

Discussion

This study was designed to assess the indigenous community with regards to the knowledge, attitudes and preventive practices on malaria, focusing on the remote indigenous settlement of Orang Asli located in the interior part of Peninsular Malaysia. Subsequently, high-risk behaviour and living conditions were also observed to identify any potential factors that could influence zoonotic malaria transmission in the community. The indigenous community normally lives in deprived environments with an inadequate intake of energy, has a poor nutritional status and expose to high parasitic infections (12–15). Traditionally leading a hunter-gatherer lifestyle in a tropical jungle environment, this indigenous people are also routinely exposed to malaria (7, 16).

In this study, almost all of the respondent acknowledges mosquito bite as the main transmission of malaria infection. These are encouraging results when compared to only 50% of indigenous people who made a correct association in the past decade (8). Recurrent visit by the health personnel from Malaysia Ministry of Health to apply IRS to the respondent' home and providing as well as updating records about their LLIN physical condition creates a personal and informal awareness education. The important awareness about malaria vectors, the pattern of mosquito behaviour (biting and resting times) and breeding sites have been linked with the severity of malaria in remote communities (17). One study in Tanzania showed a poor understanding of the vectorial capacity of the mosquito to transmit malaria has led to a high prevalence of the disease in the area (18).

Despite the very high respondents utilizing LLIN every night in this study, about half reported understanding the benefit of bed net as a prevention tool against malaria. It is not clear what could be driving the low understanding among the community, however, lack of knowledge, perceptions of risk and inadequate social behaviour change communication programme may contributing to the observed pattern (19, 20). This study also noted that a small number of respondents stated that they did not use bednets because of low mosquito population density and low disease incidence. Since people mostly remain inside houses during the evening time, improving bednet compliance could positively impact transmission risk in the village despite *An. Maculatus* mosquito vectors in the area typically showing an

exophagic behaviour. Furthermore, although people may reside inside houses during night time, they could not reasonably be expected to be under a net since household activities such as cooking need to be conducted. The bednet policy in Malaysia is to annually treat nets owned by households, replenish damaged nets and distribute LLINs so that households have a maximum of two people per net (21). Given the changing malaria situation in the country, continued efforts are needed to emphasise the benefits of operational vector control activities for eliminating any localized residual foci of transmission.

We have assessed the practice for the treatment-seeking behaviour of the respondent with the majority prefer to seek clinical treatment for malaria. Our direct observation of the studied area revealed that the community have easy access to nearby facilities and free medical services provided by government-run healthcare facilities. This suggests a good availability of health services and the accessibility of healthcare facilities in the study region (22). However, a small proportion of respondents still practice self-medication procured from the nearby sundry shop as well as observed traditional healing methods. There are multiple factors which may positively or negatively influence the practice for that treatment-seeking behaviour of individual or communities. A study by Matsumoto-Takahashi et al. revealed that malaria patients treatment-seeking behaviour has been linked with factors such as age, gender, educational status, financial resources, access to health care facilities, the severity of the disease, cultural beliefs and practices about the cause and cure of the illness (23). Furthermore, a study conducted in Nepal showed that participants preferentially consulted traditional healers suggesting a lack of appropriate facilities and awareness in that region (24). In the case of Orang Asli, they often associate diseases to ghosts and evil spirits and people normally consulted their local sorcerers who provided rituals and remedies to fight the evil spirits.

This study also uncovered that the presence of monkeys within the villages is an important potential risk factor for zoonotic malaria transmission. The probability of introduced cases of the simian malaria parasite in areas where monkeys live near human settlements would be highly likely. As indigenous populations residing primarily within natural jungle habitats and typically practising agro-subsistence nomadic lifestyle, their communities are always at risk of persistence exposure to zoonotic malaria as they come into close contact with macaques or other monkey species, which could harbour simian *Plasmodium* species particularly *P. knowlesi* and *P. cynomolgi* (25–31). A recent report of *P. knowlesi* isolated from patients from Gua Musang showed that this parasite is genetically distinguished from those of the Malaysian Borneo, indicating different evolutionary history of this parasite (32). Furthermore, the availability of *An. maculatus* as a competent vector in the area completes the transmission cycles and potentially able to transmit the parasite to the community. Even though being classified as anthropophilic, *An. maculatus* has been known to feed on monkeys when available and shown to be susceptible to simian malaria parasites in laboratory settings (33).

A number of caveats should be considered in this study. First, while the convenience household sampling approach used in this study was efficient and cost-effective, it has an inherent selection bias. Our survey was conducted during the weekdays, meaning that children and adolescent of school ages (i.e. 6–18 years) were disproportionately represented. Second, our survey underreported adult males that could

have led to an underestimation of overall data. Many adult males in the community are engaged in work activities during daytimes hours when our surveys were held, they were either be in the farm or nearby forest. The malaria KAP status in this mobile ad hard-to-reach group is not well characterised and warrant further investigation. Third, the villages in this study were selected based on the historical and unpublished records of malaria cases, the distance to the urban area, and the accessibility of field staff. The results of this study cannot be extrapolated to the general population. Nevertheless, the results can be useful to exhibit the problems around malaria KAP in the indigenous and non-indigenous people.

Conclusion

The study finding disclosed a high and acceptable level of knowledge about malaria as well as a positive attitude towards malaria control interventions accompanied by promising malaria prevention and treatment-seeking behaviour among Orang Asli in Pos Kuala Betis, Peninsular Malaysia. It has furthermore shown a good engagement and commitment between the indigenous community and the health authority in reassuring that the continued efforts to eliminate malaria in the country.

Abbreviations

IRS: Indoor residual spraying; JAKOA:Department of Orang Asli Development; KAP:Knowledge, attitude and practice; LLIN:Long lasting insecticidal nets; WHO:World Health Organization.

Declarations

Availability of data and materials

The dataset used and/or analysed during the current study are available from the corresponding authors upon request.

Consent for publication

All authors approved the final draft for journal submission.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

ZMI, PCSD, INDL, SC and MRMK conceived and designed the study. MBM, MAFAR, WW, MIMSR, EO and ZMI performed the field work. MBM and ZMI performed data cleaning and analysed the data. MBM, MAFAR and ZMI interpreted the data. MBM wrote the first draft of the manuscript. ZMI, PCSD, INDL, SC, MRMK and EO provided critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Tables

Table 1 Socio-demographic data of respondents, households and malaria control measures in Pos Kuala Betis, Gua Musang District, Kelantan, Peninsular Malaysia in 2019.

Characteristic	Overall	Angkek	Betak	Sri Galas	Lambok	Podok
Total number of surveyed households	208	65	17	40	55	31
Total population ^a , N	941	154	100	208	198	281
Total number of respondents, n (%)	536 (57)	111 (72)	42 (42)	100 (48)	132 (66.7)	151 (53.7)
Gender, n (%)						
Male	213 (39.7)	58 (52.3)	14 (33.3)	40 (40)	43 (32.6)	58 (38.4)
Female	323 (60.3)	53 (47.7)	28 (66.7)	60 (60)	89 (67.4)	93 (61.6)
Age, mean (SD), years	26.4±17.1	26.1±15.8	29±18.3	27.4±16.7	27.3±18.5	24.5±16.7
Age group, n (%), years						
6 -18	220 (41)	44 (39.7)	17 (40.5)	38 (38)	53 (40.2)	68 (45)
19 - 40	212 (39.6)	49 (44.1)	14 (33.3)	38 (38)	54 (40.9)	57 (37.8)
>40	104 (19.4)	18 (16.2)	11 (26.2)	24 (24)	25 (18.9)	26 (17.2)
Occupation ^b						
Housewife	123 (35.6)	22 (36)	7 (21.9)	34 (50)	39 (30)	21 (38.9)
Student	78 (22.6)	2 (3.3)	9 (28.1)	6 (8.8)	50 (38.5)	11 (20.4)
Agricultural sector	64 (18.6)	18 (29.5)	6 (18.8)	14 (20.6)	21 (16.2)	5 (9.3)
Labourer	49 (14.2)	17 (27.9)	7 (21.9)	4 (5.9)	8 (6.1)	13 (24)
Formal employment	19 (5.5)	2 (3.3)	2 (6.2)	8 (11.8)	3 (2.3)	4 (7.4)
Unemployed	12 (3.5)	0 (0)	1 (3.1)	2 (2.9)	9 (6.9)	0 (0)
Workplace ^c , n (%)						
Village	202 (79.2)	43 (72.9)	16 (72.7)	50 (83.3)	64 (90.1)	29 (67.4)
Town	53 (20.8)	16 (27.1)	6 (27.3)	10 (16.7)	7 (9.9)	14 (32.6)
Type of floors in the home ^d , n (%)						

Cement	83 (39.9)	32 (49.2)	4 (23.5)	22 (55)	9 (16.4)	16 (51.6)
Wood	98 (47.1)	21 (32.3)	11 (64.7)	17 (42.5)	40 (72.7)	9 (29)
Bamboo	27 (13.0)	12 (18.5)	2 (11.8)	1 (2.5)	6 (10.9)	6 (19.4)
Type of roofs in the home ^d , n (%)						
Thatch	17 (8.2)	12 (18.5)	0 (0)	0 (0)	1 (1.8)	4 (12.9)
Corrugated zinc	191 (91.8)	53 (81.5)	17 (100)	40 (100)	54 (98.2)	27 (87.1)
Type of walls in the home ^d , n (%)						
Cement	82 (39.4)	32 (49.2)	5 (29.4)	21 (52.5)	8 (14.5)	16 (51.6)
Wood	97 (46.6)	21 (32.3)	10 (58.8)	18 (45)	41 (74.5)	7 (22.6)
Bamboo	29 (14)	12 (18.5)	2 (11.8)	1 (2.5)	6 (10.9)	8 (25.8)
LLIN ownership, n (%)						
Yes	478 (89.2)	103 (92.8)	35 (83.3)	80 (80)	118 (89.4)	142 (94)
No	58 (10.8)	8 (7.2)	7 (16.7)	20 (20)	14 (10.6)	9 (6)
LLIN compliance/week, n (%)						
Every night	455 (95.2)	97 (94.2)	32 (91.4)	66 (82.5)	118 (100)	142 (100)
> 5 nights	2 (0.4)	0 (0)	2 (5.7)	0 (0)	0 (0)	0 (0)
3 - 5 nights	5 (1)	3 (2.9)	1 (2.9)	1 (1.2)	0 (0)	0 (0)
< 3 nights	16 (3.4)	3 (2.9)	0 (0)	13 (16.3)	0 (0)	0 (0)
IRS within last 12 months, n (%)						
Yes	208 (100)	65 (100)	17 (100)	40 (100)	55 (100)	31 (100)
No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

^aCensus from the Demographic Surveillance System of District Health Office Gua Musang

^bTotal of 345 respondents has no data on occupation

^cTotal of 245 respondents has no data on workplace

LLIN=Long lasting insecticide betnet; IRS=Indoor residual spraying

Table 2 Knowledge, attitude and practices (KAP) on malaria among different age groups of Orang Asli community in Pos Kuala Betis, Kelantan, Peninsular Malaysia in 2019.

Variable	Total	Age group			P-value
		6 - 18	19 - 40	>40	
Know cause of malaria, n (%)					
Yes	278 (51.9)	48 (21.8)	162 (76.4)	68 (65.4)	<0.0001
No	258 (48.1)	172 (78.2)	50 (23.6)	36 (34.6)	
Cause of malaria, n (%)					
Mosquito bite	274 (98.6)	46 (95.8)	160 (98.8)	68 (100)	-
Stagnant water	2 (0.7)	1 (2.1)	1 (0.6)	0 (0)	
Dirty surrounding	1 (0.4)	0 (0)	1 (0.6)	0 (0)	
Poor nutrition	1 (0.4)	1 (2.1)	0 (0)	0 (0)	
Know symptom of malaria, n (%)					
Yes	272 (50.7)	52 (23.6)	149 (70.3)	71 (68.3)	<0.0001
No	264 (49.3)	168 (76.4)	63 (29.7)	33 (31.7)	
Symptoms of malaria ^a , n (%)					
Fever	257 (40.6)	49 (45)	145 (41.4)	65 (38.2)	0.8587
Headache	91 (14.4)	16 (14.5)	48 (13.7)	27 (15.9)	
Rigor/chills	89 (14.1)	15 (13.8)	48 (13.7)	26 (15.3)	
Body ache	86 (13.6)	13 (11.9)	50 (14.3)	23 (13.5)	
Sweating	69 (10.9)	7 (6.4)	42 (12)	20 (11.8)	
Vomiting	27 (4.3)	6 (5.5)	14 (4)	7 (4.1)	
Nausea	8 (1.3)	3 (2.8)	3 (0.9)	2 (1.2)	
Know prevention of malaria, n (%)					
Yes	287 (53.5)	51 (23.2)	168 (79.2)	68 (54)	<0.0001
No	249	169	44 (20.8)	58 (46)	

	(46.5)	(76.8)			
Prevention of malaria*, n (%)					
Sleep under bed net	284 (50.2)	51 (54.3)	167 (49.3)	67 (50.4)	0.6406
Spray insecticide at home/surrounding	108 (19.1)	13 (13.8)	67 (19.8)	28 (21.1)	
Take medication	80 (14.1)	11 (11.7)	48 (14.2)	21 (15.8)	
Wear protective clothing	30 (5.3)	8 (8.5)	19 (5.6)	3 (2.3)	
Burn mosquito coils	28 (4.9)	7 (7.4)	16 (4.7)	5 (3.8)	
Drain/add larvicide to stagnant water	20 (3.5)	2 (2.1)	12 (3.5)	6 (4.5)	
Wear insect repellent	15 (2.7)	2 (2.1)	10 (2.9)	3 (2.3)	
Know practice on managing malaria illness, n (%)					
Yes	280 (52.2)	49 (22.3)	160 (75.5)	71 (56.3)	<0.0001
No	256 (47.8)	171 (77.7)	52 (24.5)	55 (43.7)	
Practice on managing illness*, n (%)					
Go to the clinic immediately	273 (70.9)	47 (61)	156 (71.2)	70 (78.7)	0.1515
Purchase medication from local shop	49 (12.7)	14 (18.2)	25 (11.4)	10 (11.2)	
Seek treatment from a traditional healer	40 (10.4)	8 (10.4)	25 (11.4)	7 (7.9)	
Wait out the symptoms until well	23 (6)	8 (10.4)	13 (5.9)	2 (2.2)	

*Some respondents with a combination of more than one answers

Table 3 Contributing factors of zoonotic malaria transmission among Orang Asli community in Pos Kuala Betis, Kelantan, Peninsular Malaysia in 2019.

Characteristic	Overall	Angkek	Betak	Sri Galas	Lambok	Podok	P-value
Frequency of spending the night at home, n (%)							
Every night	508 (94.8)	97 (87.4)	41 (97.6)	95 (95)	126 (95.5)	149 (98.7)	0.0014
Occasionally	28 (5.5)	14 (12.6)	1 (2.4)	5 (5)	6 (4.5)	2 (1.3)	
Monkey presence within 500m from the house, n (%)							
Yes	253 (47.2)	53 (47.7)	2 (4.8)	98 (98)	97 (73.5)	3 (2)	<0.0001
No	283 (52.8)	58 (52.3)	40 (95.2)	2 (2)	35 (26.5)	148 (98)	
Enter the nearby forest within the last 6 months, n (%)							
Yes	108 (20.1)	49 (45.4)	8 (19)	15 (15)	17 (12.9)	19 (12.6)	<0.0001
No	428 (79.9)	62 (54.6)	34 (81)	85 (85)	115 (87.1)	132 (87.4)	

Figures



Figure 1

Map of Gua Musang District (dark green) in the State of Kelantan, Malaysia where surveillances were conducted. The study site in Pos Kuala Betis located approximately 40km from Gua Musang town.