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Vulnerability Associated with Transmission of Malaria among Migrants in Nepal

Ram Chandra Poudel*, Dr. Yogendra Bdr Gurung, Rupa Siwakoti and Kesher Bdr Thapa

Central Department of Population Studies, Trivuwan University Kirtipur Kathmandu, Nepal

Abstract

Transmission of malaria determines receptivity and vulnerability characteristics of an area. As indigenous malaria cases in Nepal have declined in recent years, the number of imported cases, largely from India, has increased. In the context of increasing, trend of imported cases of malaria transmission in Nepal, it is important to understand the nature of imported cases of malaria and its vulnerability. The overall objective of this study was to examine the vulnerability associating transmission of malaria among migrants in province 5. Methods and Martials: Study designs have been descriptive and analytical, study populations have been all investigated imported cases, 159 sample sizes have been taken and secondary sources have been used for data collection. Department of health services, Epidemiology and diseases control Division has been providing data. Results: Must vulnerable age founded age group 15-59 years and mean age was found 28 ±11. Occupation was found to be statistically significantly associated with malaria species (p<0.01). Similarly, previous infection was also found to be associated with malaria species, which was statistical significant at p<0.01. Occupation was also found statistically significantly associated with use of preventive measures at p<0.01 level. Similarly duration of stay was found to be statistically significantly associates with use of preventive measures at p<0.05 level. Occupation was found statistical significantly associated with a previous history of malaria at p<0.05 level. Ethnicity was found statistical associated with treatment with national malaria treatment protocol, which was significant at p<0.05 level. Duration of stay was found statistically associates with treated with national malaria treatment protocol, which was significant at P<0.05 level. Conclusion: Must vulnerable age group was found 15-59 years group. With gender, males use less preventive measures as compared to female. Majority of Janjatis have not treated of their previous infection with national malaria treatment protocol. With occupation, labor was found must vulnerable for transmission of malaria than other occupational group. Those who stay less than 6 months or frequently visited different places were must vulnerable transmission of malaria infection.

Keywords: Vulnerability • Transmission of Malaria • Migrants

Introduction

Malaria is predominantly found in Terri belt bordering India in Nepal. In 2010 indigenous transmission was reported from 40 districts and population with indigenous transmission in 2016 substantially reduce in 27 districts [1]. The decline in malaria burden, the shrinkage of malaria map, and the achievement and maintenance of universal coverage positioned the country towards the aim of malaria elimination and set the vision malaria free Nepal by 2026 [1]. In 2004, 65 percent were indigenous and 16 percent imported among total malaria cases reported, in 2016 total of 1128 were recorded among them more than 50 percent (n=636) cases were imported [1]. The official report of DOHS shows, malaria epidemiological information province wise indicating annual malaria parasite incidence (API) 0.13 and percentage of imported cases 74.7 in Province 6 followed by API 0.08 and percentage of imported cases 74.4 in Province 5 [2]. Imported cases tend to comprise the majority of recorded cases in elimination setting [3]. The changing epidemiology of imported malaria in Nepal is a big challenge to malaria elimination. Imported malaria is one of the main threats to achievement and maintenance of elimination, with greatest risk for countries neighboring high-endemic areas such as Nepal with an open border with India [1]. Transmission of malaria determines receptivity and vulnerability characteristics of an area. Receptivity is dependent on the presences and behavior bionomics of vectors, and ecological condition favorable for transmission of malaria. Vulnerability depends on population movement to malaria endemic areas, possibility of influx of malaria patients or vectors or the possibility of malaria parasite introduced if vulnerability rate is high but receptivity is low, there is little risk of reestablishment of malaria. Where both vulnerability and receptivity are high, the risk of re-establishment is

also high [4]. Human mobility has increased in worldwide due to growing global connectivity; this connectivity hampers efforts malaria elimination through reintroduce malaria parasite in non-endemic area [5]. After malaria cases have been reduced to zero in a particular area or country, preventing a resurgence of the disease is a key concern. Malaria imported by visitors and migrants carries the risk of resuming local transmission of the disease in areas where Anopheles mosquitoes remain and conditions for spread are favourable [6]. As indigenous malaria cases in Nepal have declined in recent years, the number of imported cases, largely from India, has increased. Migrant labor is the primary source of importation, with greater numbers of Nepalese workers crossing into India for economic opportunities and returning with malaria infection [7].

In the present context of increasing, trend of imported cases of malaria transmission in Nepal, it is important to understand the nature of imported cases of malaria and its vulnerability. Main objective of the study was to explore association of vulnerability characteristics transmission of malaria among migrants.

Materials and Methods

Study area

The study area has five high and moderate risk districts located province 5 of Nepal they are Banke, Bardiya, Dang, Kapilbastu, Nawalparasi west and Rupandehi located, Terai, the southern part of Nepal bordering to India, where major malaria transmission was reported.

Ethical consideration

Ethical approval has taken from Ethical Review Committee of Tribhuvan University Central Department of Population Studies and permission was from Department of Health services, Epidemiology and Diseases Control Division for use data.

Data Analysis

Secondary sources of data were used which were obtained from Department

of Health Service, Epidemiology and Diseases Control Division. Data have collected from the Case Investigate Form (CIF) which were collected from six malaria endemic districts i.e. Banke, Bardiya, Dang, kapilbastu, Nawalparasi west and Rupendehi in earlier 2 year i.e 2017 and 2018. Among 600 total collected Case Investigated Form CIF), 159 Case Investigated Form (CIF) were taken as sample size. Data has generated individual districts in field level. Finally all data have collected in data store in the malaria section in the EDCD. All statistical analyses were carried out using the SPSS Version 23. Under the descriptive statistics the frequency percentage, mean, median and Standard Deviation (SD) was used. For inferential statistics, Pearson's chi-squared tests have been used to show association with vulnerability, transmission of malaria among migrants. Analysis was done at 95% conference interval at the level of significance of less than 5%.

Results

Descriptive analysis

Mean age of Malaria patients was found 28 ± 11. Out of the total of 159 patients, 93 percent (148) were found aged between 15 and 49 years and most of them were males (91%). Regarding ethnicity, 23.3 percent were Brahmin/Chhetri and Madhesi, followed by Dalit (22%), Janjati (18.2%) and the least were Muslims (13.2%). Most common occupation of the malaria patients were found labors (73.6%) (Table 1). Most of migrants (95.6%) were destined to India. Within India 40.8 percent went to Maharashtra, 27.6 percent to Gujarat and 13.2 percent to Uttar Pradesh. With respect to duration of stay at destination, 57.2 percent migrants stayed for less than 6 months and 42.8 percent for 6 or more months. Regarding use of preventive measures, overwhelming majority (83%) did not use any preventive measures (Table 2). Majority of patients (88.7%) were infected with Plasmodium Vivax. It was found that Plasmodium Vivex was dominated species (Table 3). One third (32.1%) migrants were previously infected with malaria parasite. Majority (82.4%) of migrant did not treated previous infection of malaria according to national malaria treatment protocol. Regarding time period of previous malaria infection 51 percent were found

Table 1. Distribution of demographic characteristic of the study participants.

Age group	Frequency	Percent
≥ 60 years	4	2.5
15-59 years	148	93.1
≤ 15 years	7	4.4
Total	**159**	**100**
Mean age standard deviation	28±11	
Gender		
Male	145	91.2
Female	14	8.8
Total	**159**	**100**
Ethnicity		
Dalit	35	22
Janjati	29	18.2
Madhesi	37	23.3
Muslim	21	13.2
Brahmin/Chhetri	37	23.3
Total	**159**	**100**
Occupation		
Labor	117	73.6
Office work	14	8.8
Security personal	10	6.3
Student	6	3.8
House hold worker	12	7.5
Total	**159**	**100**

Table 2. Distribution place of destination, stay duration of study participants and malaria species.

Destination country	Frequency	Percent
India	152	95.6
Congo	4	2.5
Saudi	2	1.3
Sudan	1	0.6
Total	**159**	**100**
Destination state within India		
Bihar	3	2
Delhi	1	0.7
Goa	4	2.6
Gujarat	42	27.6
Haryana	8	5.3
Jharkhand	1	0.7
Madhya Pradesh	2	1.3
Maharashtra	62	40.8
Rajasthan	2	1.3
Uttar Pradesh	20	13.2
Uttarakhand	7	4.6
Total	**159**	**100**
Duration of stay		
≥6 months	68	42.8
<6 months	91	57.2
Total	**159**	**100**
Malaria species		
P vivex	141	88.7
P Falciparum	18	11.3
Total	**159**	**100**

Table 3. Distribution of previous history of malaria infection among study participants.

Previous history	Frequency	Percent
No	108	67.9
Yes	51	32.1
Total	**159**	**100**
Treatment with national malaria protocol of previous infection		
No	42	82.4
Yes	9	17.6
Total	**51**	**100**
Time period of previous malaria infection		
After 1 years	26	51.0
Within 1 years	25	49.0
Total	**51**	**100**
Place of previous infection		
Maharashtra	31	60.8
Gujarat	10	19.6
Nepal	5	9.8
Haryana	2	3.9
Delhi	1	2.0
UP	1	2.0
Total	**51**	**100**

after one year and 49 percent were found within 1 year. Regarding place of previous infection 60.8 percent, 19.6 percent and 9.8 percent were found Maharashtra, Gujarat and within Nepal respectively (Table 4).

Association of Malaria Transmission

Table 4 shows the association between socio-demographic characteristics such as age, gender, ethnicity, and occupation, duration of stay and history of previous malaria infection with malaria species. Occupation was found to be statistically significantly associated with malaria species (p <0.01). About 69.2 percent labor respondents were infected with P vivax, whereas only 4.4 percent labors were infected with P falciparum. Similarly, previous infection was also found to be associated with malaria species, which was statistically significant p<0.01. Among 51 previously infected all cases were infected with P vivax. Age, gender, ethnicity and duration of stay with malaria species was found statistically insignificant. However, among patients aged 15-59 years, 82.4 percent were infected with P vivax and 10.7 percent with P falciparum. Similarly, 80.5 percent male and 8.2 percent female were infected with P vivex and 10.7 percent male and less than 1 percent female have infected with P falciparum. About 21 percent Brahmin/Chhetri infected with P vivax. This was followed by 20.8 percent Dalit, 20.1 percent Madhesi, 14.5 percent Janjati and 11.9 percent Muslim. Those who stay 6 months or more, 51.6 percent and who stay less than 6 months 37.1 percent infected with P vivax. It was found that labor was most vulnerable for transmission of P vivax; who were previously infected, they were vulnerable for transmission of malaria with P vivax. Whereas age, gender, ethnicity and duration of stay have not vulnerable for transmission of P vivex.

Table 5 shows the socio-demographic characteristic associates with use of preventive measures. Gender was found to be statistically significantly associated with use of preventive measures at p<0.01 level. About 80 percent male not used any preventive measures, whereas only 11.3 percent male used preventive measures. It Occupation was also found statistically significantly associated with use of preventive measures at p<0.01 level. About 69.2 percent labor was not used preventive measures, whereas only 4.4 percent were using preventive measures. Similarly duration of stay was found to be statistically significantly associates with use of preventive measures at p<0.05 level. About half (50.9%) stay less than six months did not use preventive measures, whereas only 6.3 percent stay less than six months did use preventive measures. Association of age, ethnicity and pervious history of malaria infection with use of preventive measure was found statistically insignificant. However, among patients more than three fourth (76.7%) aged group 15-59 years were not use any preventive measures. Regarding the ethnicity 19.5 percent Dalit and Madhesi were not use preventive measures, this was followed by 18.9 percent Barhmin/Chhetri; 16.4 percent Janjati and 8.8 percent Muslim. Who were previously infected 54.7 percent were not use as preventive measures.

It was found males were not sensible to use preventive measures; labors were not conscious to use preventive measures and who stayed less than 6 months they were not used as preventive measures. It was found variables age; ethnicity and pervious history of malaria infection with use of preventive measures not associated with use of preventive measures.

Table 6 shows that socio-demographic characteristics associate with a previous history of malaria infection. Occupation was found statistical significantly associated with previous history of malaria at p<0.05 level. Nearly half (45.9 percent) labors were not previously infected while 27.7 percent labors were previously infected. Age, gender, ethnicity and duration

Table 4. Distribution of socio-demographic characteristics associated with malaria species.

Characteristic	Malaria species (n=159)				x^2	P-value
	P Falciparum		P Vivax			
	N	%	N	%		
Age group						
≥60 years	0	0	4	2.5	0.576	0.750
15-59 years	17	10.7	131	82.4		
<15 years	1	0.6	6	3.8		
Gender						
Female	1	0.6	13	8.2	0.267	0.605
Male	17	10.7	128	80.5		
Ethnicity						
Dalit	2	1.3	33	20.8	4.257	0.375
Janjati	6	3.8	23	14.5		
Madhesi	5	3.1	32	20.1		
Muslim	2	1.3	19	11.9		
Brahmin/Chhetri	3	1.9	34	21.4		
Occupation						
Labor	7	4.4	110	69.2	28.627	**0.000***
Office work	3	1.9	11	6.9		
Security personal	6	3.8	4	2.5		
Student	1	0.6	5	3.1		
House hold worker	1	0.6	11	6.9		
Duration of stay						
≥6 months	9	5.7	82	51.6	0.434	0.510
< 6 months	9	5.7	59	37.1		
Historyof pervious infection						
Yes	0	0	51	32.1	9.585	**0.002***
No	18	11.3	90	56.6		

*Significant p-value

Table 5. Distribution of socio-demographic characteristics associated with use of preventive measures.

Characteristic	Use of preventive measures (n=159)				χ^2	P-value
	No		Yes			
	N	%	n	%		
Age group						
≥60 years	3	3(1.9)	1(0.6)	1(0.6)	1.650	0.438
15-59 years	122	122(76.7)	26(16.4)	26(16.4)		
<15 years	7	7(4.4)	0(0)	0(0)		
Gender						
Male	127	79.9	18	11.3	24.368	**0.000***
Female	5	3.1	9	5.7		
Ethnicity						
Dalit	31	19.5	4	2.5	5.768	0.217
Janjati	26	16.4	3	1.9		
Madhesi	31	19.5	6	3.8		
Muslim	14	8.8	7	4.4		
Brahmin/Chhetri	30	18.9	7	4.4		
Occupation						
Labor	110	69.2	7	4.4	77.812	**0.000***
Office work	12	7.5	2	1.3		
Security personal	1	0.6	9	5.7		
Student	6	3.8	0	0		
Household worker	3	1.9	9	5.7		
Duration of stay						
≥ 6 months	51	32.1	17	10.7	5.41	0.020*
< 6 months	81	50.9	10	6.3		
History of pervious infection						
Yes	45	28.3	6	3.8	1.449	0.229
No	87	54.7	21	13.2		
Treatment with NTP (n=51)						
Yes	9	17.6	0	0	1.457	0.227
No	36	70.6	6	6		
Time period of two infection (n=51)						
After 1 years	23	45.1	2	3.9	0.670	0.413
Within 1 years	22	43.1	4	7.8		

*Significant p-value

of stay with previous history of malaria were found statistical insignificant. However, 30.8 percent malaria patients were previously infected and 60.3 percent were not previously infected in aged 15-59 year groups. With gender 30.8 percent males and 1.3 percent female were previously infected and 60.4 percent males and 7.5 percent females were not previously infected. Regarding ethnicity 8.2 percent Janjatis were previously infected. This was followed by 6.9 percent Dalit and Madhesi, 6.3 percent Barhmin / Chhetri and 3.8 percent Muslim. Previously infected who stayed 6 or more months was 17 percent and not previously infected who stayed 6 or more months was 41 percent, while who stayed less than six months 15 percent were previously infected and 67 percent were not previously infected. It was found with occupation, labor was more vulnerable to recurrent malaria infection and independent variables age; gender; ethnicity and duration of stay were not relevant with previous history of malaria infection.

Table 7 shows that, Socio-demographic characteristic associates of

treatment with national malaria treatment protocol among previously infected. Ethnicity was found statistical associated with treatment with national malaria treatment protocol, which was significant at p<0.05 level. 23.5 percent Janjati were not treated with national malaria treatment protocol and only 2 percent Janjati were treated with national treatment protocol. Duration of stay was found statistically associates with treatment with national malaria treatment protocol, which was significant at P< 0.05 level. With regards stay duration, 42.1 percent has not treated and 13.7 percent treated with national malaria treatment protocol, those who stay less than six months. According to the result of statistical analysis, there was found an insignificant association between age groups, gender and occupation with treatment with national malaria treatment protocol. All of cases age group 15-59 years were not treated previous malaria infection with national malaria treatment protocol, whereas the age group less than 15 years, 17.6 percent were treated and 3.9 percent were not treated with national malaria treatment protocol. It revealed that who was active working age group, not attention for completed treatment. The majority of male

Table 6. Distribution of socio-demographic characteristics associates with previous history of malaria infection.

Characteristic	Previous History of Malaria infection				X²	P-value
	No		Yes			
	N	%	n	%		
Age group						
≥60 years	4	2.5	0	0.0	2	0.368
15-59 years	99	62.3	49	30.8		
<15 years	5	3.1	2	1.3		
Gender						
Male	96	60.4	49	30.8	2.230	0.135
Female	12	7.5	2	1.3		
Ethnicity						
Dalit	24	15.1	11	6.9	2.816	0.589
Janjati	16	10.1	13	8.2		
Madhesi	26	16.4	11	6.9		
Muslim	15	9.4	6	3.8		
Brahmin/Chhetri	27	17.0	10	6.3		
Occupation						
Labor	73	45.9	44	27.7	9.553	**0.049***
Office work	10	6.3	4	2.5		
Security personal	10	6.3	0	0		
Student	4	2.5	2	1.3		
House hold worker	11	6.9	1	0.6		
Duration of stay						
≥6 months	41	41.00	27	17.0	3.175	**0.075**
< 6 months	67	42.1	24	15.1		

*Significant p-value

(78.4%) were not treated previous infection with national malaria treatment protocol. With regards occupation 68.6 percent was not treated previous infection with national malaria treatment protocol.

Regarding ethnicity, Janjati was not treated their pervious infection with national malaria treatment protocol than other ethnicity and who stay less than 6 months or travel frequently not properly treatment of malaria infection with national malaria treatment protocol.

Table 8 shows result of statistical analysis, there was no significant association between socio-demographic characteristics with time period between two infections. More than half (51.1%) aged groups 15-59 years were infected after 1 year and 45.1 percent same age group were infected within 1 year. Regarding gender, males 51 percent were infected after 1 year and 45.1 percent were infected within 1 year. Regarding the occupation equal portion (43.1 percent) within 1 year and after 1 year were found labor. Who stay 6 or more months 25.5 percent infected after 1 year and 27.5 percent infected within 1 year. Those who stay less than 6 months 25.5 percent infected after 1 year and 21.6 percent infected within 1 year. Independent variables such as age; gender; ethnicity; occupation and duration of stay were not determinants for time period of two infections. It was found that socio-demographic variables were not associated with time period of two infections.

Discussion

It was discovered the majority of patients in the age group 15-59 years and mean age were found. 28 ±11 (Table 1). Similar to this study, previous study of south western Nigeria mean age for of all migrants was founded 26.6 years and found majority of migrants were active working age group [8]. Age was found a statistically insignificant association with malaria species, however majority of patients were age group 15-59 years infected with P vivax (Table 4). Previous study of Nepal showed that P vivax predominant

species that cause around 80-90 percent cases of total malaria cases in Nepal (Dhimal et al., 2014). It was found a statistical significant association between gender and use of preventive measures, p<0.01 (Table 5). This showed males had less sensible to use preventive measures than female. Females have experienced lowest malaria cases their male counterpart (91.2 percent male) (Table 1). This study was consistent with the study conducted in Ethopia among asymptomatic labor migrant, found 90.4 percent males were infected with malaria [9,10], which revealed that malaria infection was higher for males than females among migrants. This study suggested among migrant male are more vulnerable transmission of malaria because male are more exposed to vulnerable activity than females, they are also use less preventive measures against mosquito bite than female. It was found insignificant association between ethnicity and malaria species. Ethnicity was found a statistically significant association with treatment with national malaria treatment protocol (p<0.05). Majority of Janjatis have not treated of their previous infection with national malaria treatment protocol (Table 7). Regarding the time period between two infections and ethnicity was found a statistically insignificant association p>0.05. Occupation was found a statistical significant association with malaria species (p<0.05). It was found associated with use of preventive measures which was found statistical significant at p<0.01. About 69 percent labors were not used as preventive measures, whereas only 4.4 percent labors were used as preventive measures. Occupation was associated with a previous history of malaria infection, which was found statistical significant at p<0.05 level. It was found statistically significant at P<0.05 level (Table 6). A similar study conducted in Thailand, the results identified independent factors for previous malaria a high risk occupation, i.e. working primarily in the forest [11]. With regard treatment with national treatment protocol, 68.6 percent labors were not treated with national treatment protocol only 17.6 percent labors were treated with national treatment protocol (Table 7). Occupation was not associated with a time period between two infections. Data have shown near about three fourth patients have involved in labor (Table 1). Consistent to this study, Pervious study conducted in eastern Nepal found Peoples

Table 7. Distribution of socio-demographic characteristics associated of treatment with national treatment protocol (n=51).

Characteristic	Treatment with NTP (n=51)				x^2	P-value
	No		Yes			
	N	%	n	%		
Age group						
≥60 years	0	0	0	0	0.446	0.504
15-59 years	40	78.4	0	0		
<15 years	2	3.9	9	17.6		
Gender						
Male	40	78.4	9	17.6	0.446	0.504
Female	2	3.9	0	0.0		
Ethnicity						
Dalit	5	9.8	6	11.8	14.622	**0.006***
Janjati	12	23.5	1	2.0		
Madhesi	9	17.6	2	3.9		
Muslim	6	11.8	0	0		
Brahmin/Chhetri	10	19.6	0	0		
Occupation						
Labor	35	68.6	9	17.6	1.739	0.628
Office work	4	7.8	0	0		
Security personal	0	0	0	0		
Student	2	3.9	0	0		
House hold worker	1	2.1	0	0		
Duration of stay						
≥6 months	25	49.0	2	3.9	4.139	**0.042***
< 6 months	17	33.3	7	13.7		

*Significant p-value

Table 8. Distribution of socio-demographic characteristics associated of time period of two infections.

Characteristic	Time period of two infection (n=51)				x^2	P-value
	No		Yes			
	N	%	n	%		
Age group						
≥60 years	0	0	0	0	2.165	0.141
15-59 years	23	45.1	26	51.1		
<15 years	2	3.9	0	0		
Gender						
Male	23	45.1	26	51.0	2.165	0.141
Female	2	3.9	0	0		
Ethnicity						
Dalit	4	7.8	7	13.7	2.761	0.599
Janjati	6	11.8	7	13.7		
Madhesi	7	13.7	4	7.8		
Muslim	2	3.9	4	7.8		
Brahmin/Chhetri	6	11.8	4	7.8		
Occupation						
Labor	22	43.1	22	43.1	6.983	0.072
Office work	0	0	4	7.8		
Security personal	0	0	0	0		
Student	2	3.9	0	0		
House hold worker	1	2.0	0	0		
Duration of stay						
≥6 months	14	27.5	13	25.5	0.184	0.668
<6 months	11	21.6	13	25.5		

*Significant p-value

doing physical activities like laborers were among the most infected [12]. It may be due to their nature of work which compels them to stay outside till late in the evening and even not use any preventive measures, not treated previous infection with national malaria treatment protocol. Migrant labor was the primary source of importation, with greater numbers of Nepalese workers crossing into India for economic opportunities and returning with P. Falciparum malaria. Consist with previous study this study has discovered almost migrants (95.6%) have destined to India, contrast, previous study most of migrants have returned with P vivax (Table 2).

With respect to duration of stay in place of destination 57.2 percent migrants were stayed for less than 6 months and 42.8 percent stayed for 6 or more months (Table 2). Stay duration was associated with use of preventive measures which has found statistically significant at p<0.05 level (Tables 4-7). It was revealed who stay less than six months in place of destination were not used as preventives measures against mosquito bite. A Studies con- ducted in Indonesia among migrants from Java to Irian Jaya demonstrated that non-immune migrants would develop protective immunity towards malaria within 12–24 months after moving to the new area [13]. This study concluded that who stay less than 6 months or frequently visited different places were more vulnerable transmission of malaria infection.

Conclusion

Must vulnerable age group was found 15-59 years group. Statistically significant association was found gender with use of preventive measures, male use less preventives measures as compared to female. Ethnicity was found statistically significant association with treatment with national malaria treatment protocol, majority of Janjatis have not treated of their previous infection with national malaria treatment protocol. With occupation, labor was found must vulnerable for transmission of malaria than other occupational group, they were used less preventive measures, more infected with p vivax, not treated their previous infection with national malaria treatment protocol. Similarly, security personal had less vulnerable of transmission of p vivax, they were used more preventive measures than others. Those who stay less than 6 months or frequently visited different places were must vulnerable transmission of malaria infection. Stay duration was associated with use of preventive measures which was found statistically significant. Stay less than six months less likely to use preventive measures. It was found stay less than 6 months less vulnerable being transmitted malaria among who had previously infected than who stay more than 6 months. Who destined for India was must vulnerable transmission of malaria than other country.

Recommendation

This study revealed that most vulnerable age group was working age group. So, in short term, programs should be focused increases awareness to prevent malaria transmission among working age groups. In occupation, labor was more vulnerable they were not aware about transmission of malaria. So, more attention to be given for labor migrants during passes the boarder. Those who stay less than six months or frequently movement different places were more vulnerable. So, the program should focus to mover, it requires two country collaboration, the government of India should alert the people about use preventive measures during visit malaria endemic area. Previous history of malaria Infection was found vulnerability.

To minimize this vulnerability, required complete treatment of malaria infection during their current attack.

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