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Engagement of the private health sector in communication to enhance malaria awareness in communities: Contributing to malaria elimination

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ABSTRACT

Background: Countries in the Mekong sub-region are making significant progress towards malaria elimination, driven by strong commitment and multi-sectoral cooperation.

Objectives: This study examines changes in malaria knowledge among adults aged 18 and older in four high-risk provinces of Vietnam due to the Enhancing Private Sector's Responsibility in Vietnam's Malaria Elimination Program, implemented from 2021 to 2023.

Methods: We conducted a baseline and end-line cross-sectional study on the program "Enhancing Private Sector's Responsibility in Vietnam's Malaria Elimination." We utilized questionnaires from previous studies and employed multi-stage cluster random sampling techniques to recruit 736 adults from four high-risk provinces in Vietnam. Logistic regression analysis was used to identify the factors associated with malaria knowledge among the participants.

Results: There was a significant increase in the proportion of individuals with good knowledge of malaria prevention, rising from 36.7% at baseline to 78.6% at the end-line. A significant relationship was observed between age groups and knowledge of malaria prevention: for individuals aged 60 and older, the adjusted odds ratio (aOR) was 2.40 (95% CI: 1.29-4.45) at baseline, while for those aged 45-59, the aOR was 2.05 (95% CI: 1.19-3.52) at end-line. Individuals who received advice from a private pharmacy or clinic knew about malaria prevention nearly four times compared to those who did not receive such advice (aOR = 3.84, 95% CI = 1.52-10.22).

Conclusion: The "Enhancing Private Sector's Responsibility in Vietnam's Malaria Elimination" program increased malaria awareness among individuals in the targeted areas. However, it was noted that there is still a significant lack of knowledge among those who are uneducated. This indicates the need for more focused educational campaigns tailored specifically to this segment of the population.

Keywords: Health education, Knowledge, Malaria, Private health sector

1. Introduction

Malaria is a preventable and treatable, life-threatening disease mainly found in tropical countries. However, if not diagnosed promptly and treated effectively, a case of uncomplicated malaria can evolve into a severe form of the disease, which can be fatal [1-4]. Consequently, the health sector regards malaria prevention as a top priority, with party committees, local authorities, and the community in endemic regions all sharing this responsibility [5]. One of the primary strategic goals of the national program in Vietnam is to communicate and educate the public about disease prevention and control [6]. The WHO Global Technical Strategy (2016-2030) envisions a malaria-free world by 2030. To achieve this goal, a holistic approach aligned with the Sustainable Development Goals (Target 3.3) is necessary. This approach aims to address the underlying determinants of malaria while implementing effective malaria intervention activities [7]. Numerous malaria prevention activities have been implemented in countries around the world, each utilized with varying levels of emphasis during different intervention phases: prevention, control, and elimination. These efforts involve both public health systems and private healthcare facilities. Foresters are frequently at high risk of contracting malaria because they spend extended periods in the forest. On weekends, they typically return home and visit private medical facilities to consult doctors and purchase medications where they can get appropriate advice [8]. Assessing changes in knowledge about malaria prevention and identifying related factors among forest goers, who are at high risk of malaria, is crucial for Vietnam to develop effective strategies for malaria elimination. Therefore, we conducted this study to examine private health sector engagement in community communication aimed at enhancing malaria awareness and contributing to malaria elimination efforts. Specifically, we sought to describe changes in malaria prevention knowledge among foresters working in high-risk malaria areas and analyse factors associated with it in Vietnam.

2. Methods

2.1 Study Area

This study was conducted in four provinces in Vietnam that are endemic to malaria: Gia Lai, Dak Lak, Dak Nong, and Binh Phuoc. These provinces share borders with Cambodia, engage in trade activities, contain

national forests, and have potential risks for malaria transmission.

2.2 Study Design

We conducted a cross-sectional study in two independent phases. The baseline survey took place from September to December 2021, while the end line survey occurred from September to December 2023.

2.3 Sample Size and Sampling

The subjects of the study were forest goers' inclusion Criteria: Indigenous people are defined as those who work and live in the commune for more than six months and spend at least one night per month sleeping on the farm or in the forest. Mobile people are individuals from other communes who visit the area, stay for less than six months, have no intention of settling long-term, and live or work near the edge of the forest or within it. Exclusion Criteria: Individuals who are under 18 years old and are unable to understand and respond to the questions posed by the data collector will be excluded from the study.

Sample size

To estimate a population proportion with a specified level of absolute precision, we used the following formula:

$$n = \frac{Z^2_{1-\frac{\alpha}{2}} P(1-P)}{d^2}$$

$Z_{(1-\alpha/2)}$: Reliability coefficient (with confidence 95%, $Z_{1-\alpha/2} = 1,96$)

α: Statistical significance level (α = 0,05)

d: The absolute precision, d = 0,05

p: Choose p=0.745 (The proportion of individuals with good knowledge of malaria prevention is 74.5%, according to research by *Nguyen Minh Nhat*) [9].

DE: Design effect in case of using cluster sampling method (DE=2)

We calculated the minimum required sample size as N = 584. In fact, we collected 736 participants at baseline and 696 responses at endline survey.

Sampling

We used a multi-stage sampling technique: Step 1 (select districts): In each province, we selected one district that had the highest number of malaria cases in 2019 [10]. Step 2 (select communes): Within each of the selected districts, three communes were chosen which reported the highest number of malaria cases in 2019. This resulted in a total of 12 communes across the four provinces.

Step 3 (select subjects): We used a convenience sampling method to select participants. Started by interviewing the first person encountered who lives near the upland forest and continued interviewing until the desired sample size was achieved.

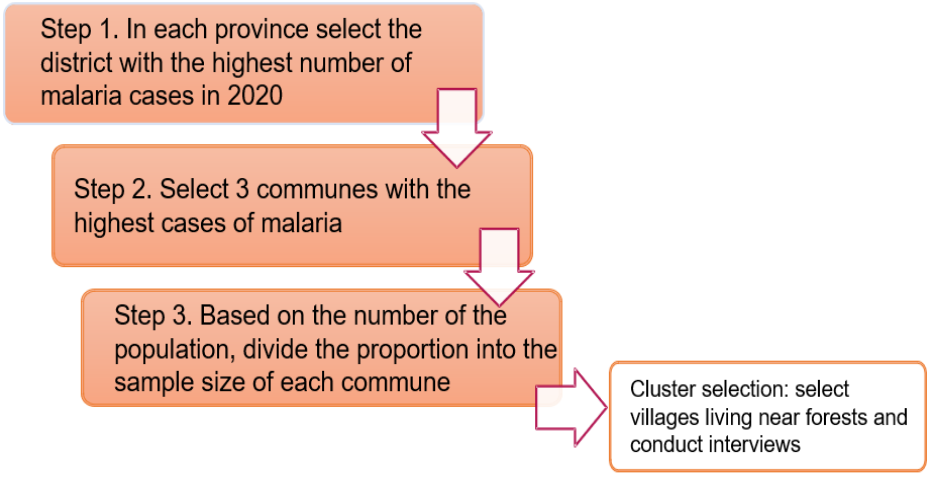

Figure 1: The sample selection process

2.4 Variables

Demographic characteristics included age, gender, ethnicity, religion, education, income, working hours, and health insurance status.

Knowledge about malaria prevention included causes, symptoms, harms, treatment, and preventive measures.

The output variable in this study is the Knowledge Classification, divided into two groups: Good and Not Good, with a cut-off score of 80% of the total knowledge score.

2.5 Data Collection

Data were collected through direct interviews conducted by the staff of the commune health station. Before the interviews, the data collectors underwent a one-day training session on the content of the questionnaire. Additionally, an online supervisor, using Global Positioning System (GPS), accompanied the data collectors for one or two days during the interviews.

A structured questionnaire was developed based on studies from the Vietnam National Institute of Malaria, Parasitology, and Entomology, along with contributions from other authors, and was tested on a target group of foresters and mobile populations [8, 11]. The results of the pilot study indicated that the Cronbach's alpha reliability was 0.94.

2.7 Data Analysis

A round-by-round stratified descriptive analysis was conducted, comparing baseline and endline data. Proportions were utilized to describe categorical variables, using a cutoff point of 80% to evaluate the malaria prevention knowledge among the study subjects [12].

Data were collected using KoboToolbox software and analysed using STATA 16 software.

Descriptive statistics: illustrated the mean, frequency, and proportion of research variables.

Inferential statistics: Logistics regression was used to analyse the relationship between KAP of malaria prevention and other factors by $\chi 2$ test at the significance level $\alpha = 0.05$. The odds ratio (OR) and confidence interval for OR (95%CI) were used to determine the strength of the association. First, we used previous studies to identify the relevant factors. Next, we used univariate regression for all variables, and only statistically significant variables were included in the multivariate regression model.

3. Results

The characteristics of participants from both the baseline and end-line surveys. A consistent pattern emerged in both surveys. Most participants were male, aged between 18 and 49 years, and had completed only primary education or lower. The majority were self-employed, and nearly all were married or living with a partner. Over 88% of 736 participants had health insurance, and more than half reported very low incomes, earning less than 3 million VND (55.9% at baseline and 59.5% at the end line) (Table 1).

Table 1: Characteristics of Participants at Baseline and Endline Surveys

Demographic characteristics	Baseline (n=736)		Endline (n=696)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender				
Male	470	63.9	444	63.8
Female	266	36.1	252	36.2
Age groups				
18-44 years old	560	76.1	478	68.7
45-59 years old	128	17.4	162	23.3
≥ 60 years old	48	6.5	56	8.0
Mean ± SD	37.9 ±12.6		39.9±12.8	
Education level				
Illiteracy	97	13.2	67	9.7
Can read and write simple words	167	22.7	135	19.4
Primary school	221	30.0	240	34.5

Demographic characteristics	Baseline (n=736)		Endline (n=696)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Secondary school	174	23.5	172	24.7
High school	65	8.8	63	9.0
College	7	0.9	9	1.3
University, Postgraduate	5	0.7	10	1.4
Marital status				
Not married	61	8.3	42	6.0
Married (Having a spouse)	639	86.8	620	89.1
Separated/divorced/widowed	36	4.9	34	4.9
Monthly income				
≤ 1.500.000 VND	217	29.5	138	19.8
1.500.000 VND – 2.250.000 VND	187	25.4	276	39.7
> 2.250.000 VND	332	45.1	242	40.5
Health Insurance				
Yes	652	88.6	624	89.7
No	84	11.4	72	10.3

SD = standard deviation, VND = Vietnam Dong.

The knowledge of malaria prevention among all respondents

Most participants in the study recognized that mosquito bites were the primary cause of the disease and understood that delayed treatment can be fatal, a finding that remained consistent from the baseline to the end-line. The percentage of individuals who were aware of the three main symptoms of malaria increased from 43.1% at baseline to 60.3% at the end-line. Additionally, at the end-line survey, a larger percentage of participants demonstrated awareness of malaria prevention measures. Overall, there was a significant increase in the proportion of individuals with good knowledge of malaria prevention, rising from 36.7% at baseline to 78.6% at the end-line. With a P-value less than 0.05, these results were statistically significant (Table 2).

Table 2: Knowledge of Malaria Prevention

Items	Baseline (n = 736)		Endline (n = 696)		P-value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Recognize that mosquito bites are the disease's primary cause	631	85.7	671	96.4	<0.001
Symptoms of malaria (Multiple choice)					
Fever	625	84.9	670	96.3	<0.001
Chills	537	72.9	574	82.5	<0.001
Sweating	325	44.2	442	63.5	<0.001
Headache	405	55.0	419	60.2	0.04
Nausea	71	9.7	75	10.8	0.04
Other symptoms	83	11.3	28	4.0	<0.001
Recognize the three primary signs of malaria (fever, chills, and sweating)	317	43.1	420	60.3	<0.001

Items	Baseline (n = 736)		Endline (n = 696)		P-value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Recognize that malaria can be fatal if not treated promptly	616	83.7	634	91.1	<0.001
Recognize malaria prevention measures (Multiple choice)					
Sleeping in a hammock/net	683	92.8	687	98.7	<0.001
Wear long-sleeved clothes	264	35.9	452	64.9	<0.001
Use mosquito coils and mosquito repellent creams	323	43.9	381	54.7	<0.001
Spray mosquito killer	182	24.7	250	35.9	<0.001
Clear bushes around the residence	198	26.9	238	34.2	0.003
Good knowledge about malaria prevention	**270**	**36.7**	**547**	**78.6**	**<0.001**

Note: p-value of Pearson's chi-square test

The outcomes of the multivariate analysis regarding the factors associated with knowledge of malaria among respondents in both the baseline and end-line evaluations are presented in Table 3. There were similarities and differences between the baseline and end-line results. A significant relationship was observed between age groups and knowledge of malaria prevention: for individuals aged 60 and older, the adjusted odds ratio (aOR) was 2.40 (95% CI: 1.29-4.45) at baseline, while for those aged 45-59, the aOR was 2.05 (95% CI: 1.19-3.52) at end-line. Additionally, receiving information from health workers was linked to increased knowledge of malaria prevention at both rounds: the aOR was 1.58 (95% CI: 1.05-2.37) at baseline and 2.44 (95% CI: 1.27-4.69) at end-line. While no correlation was identified at baseline, the end-line survey revealed that knowledge of malaria prevention was associated with both income (aOR of 8.94 and 4.58; 95% CI: 5.26-15.18 and 2.17-7.04, respectively) and education level (aOR of 3.59 and 3.01; 95% CI: 1.92-7.88 and 1.49-6.30, respectively).

Table 3 also illustrated the relationship between knowledge of malaria prevention and receiving advice from private health facilities. At baseline, before the project was implemented, private health facilities did not provide malaria consultation. The findings indicated that during the project period, Individuals who received advice from a private pharmacy or clinic had an odds ratio of 3.84, meaning they were nearly four times more likely to have knowledge of malaria prevention compared to those who did not receive such advice (aOR = 3.84, 95% CI =

1.52-10.22), which was statistically significant.

Table 3: Factors related to knowledge of malaria prevention (a multivariate regression analysis)

Factors	Baseline (n = 736)				Endline (n = 696)			
	Knowledge		OR (95% CI)	aOR (95% CI)	Knowledge		OR (95% CI)	aOR (95% CI)
	Not good n (%)	Good n (%)			Not good (%)	Good n (%)		
Age groups (years)								
18-44	358 (63.8)	203 (36.2)	ref	ref	111 (23.3)	367 (76.7)	ref	ref
45-59	85 (66.9)	42 (33.1)	0.87 (0.58-1.31)	0.94 (0.62-1.43)	25 (15.4)	137 (84.6)	1.65 (1.02 - 2.66)	2.05 (1.19-3.52)
≥ 60	23 (47.9)	25 (52.1)	1.91 (1.06-3.46)	2.40 (1.29-4.45)	13 (23.2)	43 (76.8)	1.01 (0.51- 1.92)	1.85 (0.84-4.09)
Education level								
Illiteracy	64 (66.0)	33 (34.0)	ref	ref	25 (32.8)	42 (67.2)	ref	ref
Can read & write simple words/ Primary school	256 (66.0)	132 (34.0)	1.01 (0.62-1.59)	1.06 (0.65-1.73)	36 (26.7)	99 (73.3)	1.63 (0.87-3.05)	1.61 (0.80-3.25)
Secondary school	103 (59.2)	71 (40.8)	1.33 (0.79-2.24)	1.45 (0.84-2.52)	41 (17.1)	199 (82.9)	2.88 (1.58-5.25)	3.59 (1.92-7.88)
High school and above	43 (55.8)	34 (44.2)	1.53 (0.82-2.83)	1.68 (0.87-3.26)	47 (18.5)	207 (81.5)	2.62 (1.45-4.71)	3.01 (1.49-6.30)
Monthly income (VND)								
≤ 1.000.000	109 (58.3)	78 (41.7)	ref	ref	69 (50.0)	69 (50.0)	ref	ref
1.000.000-3.000.000	220 (66.3)	112 (33.7)	0.71 (0.49-1.02)	0.72 (0.49-1.06)	28 (10.1)	248 (89.9)	8.85 (5.29-14.80)	8.94 (5.26-15.18)
> 3.000.000	137 (63.1)	80 (36.9)	0.81 (0.54-1.21)	0.79 (0.52-1.21)	52 (18.4)	230 (81.6)	4.42 (2.82-6.930	4.58 (2.17-7.04)
Received information about malaria prevention from health workers								
No	109 (71.7)	43 (28.3)	ref	ref	21 (38.9)	33 (61.1)	ref	ref
Yes	357 (61.1)	227 (38.9)	1.51 (1.08-2.10)	1.58 (1.05-2.37)	128 (19.9)	514 (80.1)	2.55 (1.43-4.56)	2.44 (1.27-4.69)
Get advice from private clinics/pharmacies								
No					144 (23.0)	481 (77.0)	ref	ref
Yes					5 (7.0)	66 (93.1)	3.95 (1.56-9.99)	3.84 (1.52-10.22)

Note: Bold-face value indicates a statistically significant correlation with a p-value less than 0.05.
aOR = adjusted odds ratio, CI = confidence interval, VND = Vietnam Dong

4. Discussion

This study examined the changes in malaria knowledge among adults aged 18 and older

in four high-risk provinces of Vietnam after the implementation of the "Enhancing Private Sector's Responsibility in Vietnam's Malaria Elimination" program. Overall, there was a significant improvement in malaria knowledge from the baseline to the end-line survey, particularly regarding symptoms and prevention methods. Furthermore, individuals with higher education levels, higher incomes, and access to information about malaria prevention demonstrated greater knowledge about the disease.

The understanding of malaria was limited in the baseline survey but increased significantly by the end line, highlighting the impact of the implemented program. In our end-line survey, the percentage of individuals with good knowledge about malaria aligns with findings from several studies conducted worldwide [13-15]. However, this result is lower than some regional and global studies [16, 17] while being higher than others [18-24]. This difference can be attributed to variations in the data collection location and timing. Respondents from four rural provinces in the central highlands of Vietnam likely have lower education levels, resulting in a reduced capacity to access information about malaria compared to those living in urban areas. Additionally, there are still many regions where education and healthcare access are challenging, leading to lower awareness about malaria. This situation is often linked to disparities in education, limited access to information, and a lower likelihood of utilizing healthcare services. Consequently, this study may provide valuable insights for developing educational campaigns aimed specifically at these segments of the community. Furthermore, the estimation of the percentage of individuals with good knowledge at various levels can be enhanced through the use of different cut-off points. Our research indicated several factors related to community knowledge about malaria prevention. These factors include age group, education level, income, and the receipt of information regarding malaria prevention. Our findings show that older individuals possess better knowledge of malaria prevention compared to younger groups, which aligns with results from other studies [11, 20]. This can be attributed to the observation that older individuals are more likely to have been exposed to or contracted malaria during previous outbreaks. Additionally, they tend to have received more medical attention than younger people. Those with higher education levels typically possess greater knowledge about malaria prevention,

which aligns with findings from global research [11, 13, 22, 25, 26]. This is entirely understandable, as individuals who have attended school are more likely to have learned about illnesses and infectious diseases. As a result, they tend to be more aware of the importance of protecting their health and actively seeking health information. Additionally, people with higher incomes generally possess more knowledge about malaria prevention compared to those in low-income groups, a finding that is consistent with studies conducted worldwide [11, 22, 25, 27]. This is logical because individuals with higher incomes usually reside in better, more expensive homes, take greater precautions against mosquito bites, and have access to superior healthcare facilities. The findings of this study align with previous research, which indicated that those who received information about malaria prevention were more knowledgeable than those who did not [11, 28]. Individuals who obtained malaria prevention information from private healthcare facilities demonstrated a higher level of knowledge compared to those who did not receive such information. As part of the project, these facilities have received training in effective communication and malaria prevention strategies. This finding is particularly significant because, in remote and underserved areas, public health services may not be able to meet all medical care needs. Consequently, many individuals, especially foresters who only return home on weekends, prefer to seek examinations and medications from private healthcare facilities [29].

Healthcare providers often serve as a trusted source of information and services related to malaria, thanks to their specialized knowledge and expertise in the field [30]. Improving the skills of healthcare professionals working in private healthcare facilities is crucial for empowering them to take greater responsibility in preventing malaria and managing the overall health burden on the public health system. This enhancement will be vital for addressing infectious diseases like malaria in the future. The results provide evidence that the implementation of the program has led to positive changes. This initiative was part of Vietnam's efforts to prevent malaria. We used cluster random sampling and a large sample size, which makes our findings applicable across the country. Participants in the final survey demonstrated greater knowledge of malaria prevention, likely due to increased

exposure to educational materials throughout the program. However, there are some limitations to consider. We need to recognize the possibility that public understanding may have been influenced by other malaria-related interventions in the study areas or by direct effects from the public health system. Additionally, since the data were collected for a cross-sectional study, this work cannot determine any causal relationships.

Based on our findings, this study has several implications for future research. The program has successfully enhanced knowledge about malaria prevention among the surveyed participants by the end of this assessment. This improvement holds significant implications for upcoming educational outreach initiatives. Future research should evaluate the extent to which each project has positively impacted knowledge, attitudes, and practices related to malaria prevention. Additionally, these campaigns must adopt a more targeted approach, especially towards individuals with lower levels of education, particularly in areas with a high presence of ethnic minorities.

5. Conclusion

In summary, the initiative to enhance the private sector's responsibility in Vietnam's malaria elimination program has successfully increased awareness of malaria in the intervention areas. These results underscore the importance of comprehensive community-based malaria management programs to bolster prevention efforts in Vietnam through awareness-raising campaigns. The findings highlight the need for targeted strategies focused on various high-risk populations to effectively raise awareness of malaria and its associated risk factors. Furthermore, these results illustrate that the private sector can play a valuable role in future health programs, including those aimed at malaria control.

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Author contributions

LMD: Conceptualization, data curation, formal analysis, methodology, writing original draft, writing review and editing. NDT: Conceptualization, methodology, supervision, writing original draft, writing review and editing. LXH: Conceptualization, methodology, writing original draft, writing review and editing.

Declaration

Ethics approval and consent to participate

The study was approved by the Institutional Review Board (IRB) at the University of Public Health under Decision No. 206/2021/YTCC-HD3, dated May 7, 2021.

Competing interests

There are no conflicts of interest declared by the author (s).

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