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THE EFFECT OF POSITIVE DEVIANCE ON MALARIA PREVENTION BEHAVIOUR IN JAYAPURA CITY ENDEMIC AREA

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ABSTRACT

Introduction: Malaria is an infectious disease that is still a public health problem in the world, including in Indonesia. Malaria can affect everyone, both men and women in all age groups from infants, and children to adults. Jayapura City is the second-highest area in Papua. The Annual Parasite Incidence (API) rate in Jayapura City in 2019 was 92.55‰, in 2020 it was 89.35‰, and in 2021 it was 99.49‰. This study aims to analyze the effect of the positive deviance approach on reducing malaria incidence in residents in endemic areas of Jayapura City.

Methods: This research was conducted by mixed methods in 2 stages, namely stage 1 with quantitative research with rapid survey, and stage 2 with quasi-experimental (intervention). The results of the qualitative research showed that 14 positive deviance in malaria prevention were identified.

Results: The results of quantitative research show that there is a relationship between positive deviance and malaria incidence (p = 0.000), there is a relationship between gender and malaria incidence (p = 0.000), and there is a relationship between occupation and malaria incidence (p = 0.000). Positive Deviance identified, only 7 are associated with malaria incidence, namely cleaning the living environment (p = 0.000), using eucalyptus oil (p = 0.013), using pork oil (p = 0.013), drinking boiled water of sambiloto leaves (p = 0.005), drinking mung bean boiled water (p = 0.031), consuming papaya leaf vegetables (p = 0.005), and wearing long sleeves (p = 0.000). Multivariate analysis showed that the most influential factor in malaria incidence was positive deviance (p=0.000; 95% CI for Exp(B)=14.827; 4.866-45.180).

Conclusion: The positive deviance approach is an innovative locally specific approach to prevent malaria in the pre-elimination stage of malaria and even in the elimination era in Jayapura City.

Keywords: Malaria, Positive Deviance, Pig Oil, Sambiloto, Green Mung Beans, Papaya Leaves

INTRODUCTION

Malaria is an infectious disease that is still a public health problem in the world, including in Indonesia. The disease, which is caused by Protozoa Genus Plasmodium transmitted through mosquito bites, affects almost all regions of the world. Malaria can affect all people, both men and women in all age groups from infants, and children to adults [1]. Malaria can be prevented and cured, but it can also cause death if not treated properly [2].

Based on the WHO report in the world malaria report (World Malaria Report 2021), it is known that there is an increase in access to malaria interventions, especially in Sub-Saharan Africa, which is the region with the heaviest malaria burden in the world. Deaths from malaria in the Sub-Saharan Africa region in 2020 accounted for 93% of total malaria deaths. In addition, there was an increase in the use of insecticide-treated bed nets in populations at risk of malaria by double until 2018 but showed a decline by the end of 2020 which is expected due to the impact of the COVID-19 pandemic [3,4].

The Southeast Asian region, including Indonesia, is still a malaria-endemic country until 2020 and ranks as the second-highest country with the highest number of malaria cases in the Southeast Asian region. Therefore, Indonesia has a big task in controlling malaria transmission to realise a malaria-free country by 2030 (WHO, 2021).

In Indonesia, efforts have been made to control malaria in malaria elimination preparation and maintenance areas. One of the efforts made is by issuing technical guidelines for malaria elimination assessment to assist health workers and related sectors in conducting malaria elimination assessments [5].

In addition, the Ministry of Health in 2020 has also issued a technical guideline book for the implementation of malaria migration surveillance in health services and port health port offices which aims to provide guidelines to health workers to conduct malaria migration surveillance in the field. This technical guideline aims to help provide guidelines to programme managers to supervise and monitor imported and local malaria cases, especially in areas targeted to achieve malaria elimination [6].

Other research concluded that the importance of involving community components including private sector stakeholders from the beginning is important as part of malaria control efforts in an effort to achieve malaria elimination [7]. The positive deviance approach can be an effective tool for changing community behaviour in order to reduce the Annually Paracite Incidence (API), control and eliminate malaria incidence in an area by strengthening the community [8,9].

Malaria control models for sedentary populations in endemic areas are lacking, prompting researchers to explore interventions using positive deviance in Jayapura City. Employing a three-stove approach, community empowerment aims to reduce malaria incidence. Government efforts, supported by stakeholders, require active community participation, crucial for success. This research is vital due to malaria's social impact, causing unrest and rapid deaths, and economic consequences, leading to increased state budget allocations for treatment. Addressing these issues through targeted interventions is crucial for overcoming social and economic challenges.

METHODS

The research method will be carried out s in 2 (two) stages of research, namely research phase 1 and phase 2 with different research methodologies with the following explanation:

1. Phase 1 Research

The study comprised two phases. Phase 1 employed a quantitative approach, while Phase 2 involved a rapid survey exploring positive deviance behaviors and their influence on malaria incidence. This phase included quasi-experimental research, with the study group divided into an intervention group, receiving positive deviance-based interventions, and a control group, receiving only education about positive deviance without direct intervention. The survey questionnaire was based on positive deviance behaviors identified in Phase 1.

Location and Time of Research

Phase 2 of this research was conducted in South Jayapura District, Jayapura City, Papua Province in October - November 2023.

Population and Sample

The population in this study were all patients and non-malaria patients in South Jayapura District, Jayapura City. The sampling technique for quantitative data used purposive sampling with a sample size of 120 respondents. The sample criteria for quantitative data are as follows:

a. Inclusion Criteria

1) Respondents who live in South Jayapura District

2) Willing to be a respondent

3) The sample consisted of malaria positive and non-positive patients.

4) All genders and healthy

b. Exclusion Criteria

1) If not willing to be a respondent

2) Outside of the research area

2. Phase 2 Research

Phase 2 research involved the intervention of positive deviance behaviours in local residents as the treatment group in the experimental research. Quantitative data analysis using SPSS included univariate, bivariate and multivariate analyses.

Univariate analysis: Provides an overview and characteristics of respondents and study variables through frequency distribution.

Bivariate Analysis: Assess the association between two variables using the chi-square test for sociodemographic factors and a Paired t-test or Wilcoxon Signed-Rank Test for differences in behaviour before and after the intervention.

Multivariate Analysis: Involves logistic regression tests to determine the variables that have the most influence on malaria incidence and differences in positive deviance behaviour after the intervention.

Research Output

The output or output obtained from phase 1 research or rapid survey research is in the form of a document that can be used by samples or respondents for intervention or experimental research. The document is a pocketbook entitled "Positive Deviance to Prevent Malaria".

This handbook is a document formulated based on the findings or identification of positive deviance in the sample at the quantitative research stage, namely the rapid survey (stage 1), which is then used as a tool in intervention or experimental research.

RESULTS AND DISCUSSION

Result

Phase 1 Research (Quantitative Research*)*

Univariate Analysis

Univariate analysis was conducted to determine the characteristics of respondents involved in the implementation of the malaria *Positive Deviance* rapid survey as follows:

Table 1. Characteristics of *Positive Deviance* Respondents Among Local Residents in Malaria Endemic Areas of Jayapura City, 2023

Characteristics	n	%
Age		
Productive	**113**	**94,2**
Not Yet/Not Productive	**7**	**5,8**
Gender		
Male	**52**	**43,3**
Women	**68**	**56,7**
Marital Status		

Married	**106**	**88,3**
Unmarried	**14**	**11,7**
Last Education		
Not in School	**6**	**5,0**
Primary school or equivalent	**56**	**46,7**
Junior high school or equivalent	**24**	**20,0**
High school or equivalent	**27**	**22,5**
Higher Education	**7**	**5,8**
Jobs		
Not Working	**53**	**44,2**
Fisherman/Farmer	**14**	**11,7**
PNS/TNI/POLRI	**2**	**1,7**
Planters	**10**	**8,2**
Labour	**11**	**9,2**
Private Employee	**30**	**25,0**

Source: Primary Data, 2023

Table 1 shows that of the 120 respondents involved in the *rapid survey*, most were in the productive age group of 15-64 years old, namely 113 people (94.2%). Respondents were also predominantly female with 68 people (56.7%) and married with 106 people (88.3%). The majority of respondents' last education was elementary school or equivalent as many as 56 people (46.7%) and based on employment, more respondents did not work, namely 53 people (42.2%).

Some important points and additional information related to respondents' initial knowledge of malaria can be seen in the following table:

Table 2. Distribution of Knowledge of *Positive Deviance* Respondents among Local Residents in Malaria Endemic Areas of Jayapura City, 2023

Issue	Yes		No / Never	
	n	%	n	%
Ever heard of malaria	92	76,6	28	24,4
Know the causes of malaria	17	14,2	103	85,8
Know the symptoms of malaria	37	30,9	83	69,1
Know the dangers of malaria	44	36,6	76	63,4
Know how to prevent malaria	29	24,1	91	75,9
Know how to treat malaria	21	17,5	99	82,5

Source: Primary Data, 2023

Table 2 shows that the baseline knowledge of respondents involved in the rapid survey about malaria was minimal. Although 76.6% of respondents had heard of malaria before, 85.8% of them did not know the cause of malaria. In addition, 69.1% did not know the symptoms of malaria and 63.4% of respondents did not know the dangers of malaria. Most respondents also did not know how to prevent malaria, 80.6%, and 86.1% did not know how to treat malaria.

Bivariate Analysis

Bivariate analysis aims to present two variables presented in one table to see the frequency, relationship or meaning between the two variables analysed. Analysis of the relationship between the research variables and the incidence of malaria in Jayapura City in 2023 is presented in table 5 below.

Table 3. Relationship between study variables and malaria incidence among local residents in malaria endemic areas of Jayapura City in 2023

Research Variables	Malaria incidence				Total		*p-value*
	Yes		No				
	n	%	n	%	n	%	
Positive Deviance							
No	29	74,4	10	25,6	39	100	0,000
Yes	11	13,6	70	86,4	81	100	
Gender							
Male	32	61,5	20	38,5	52	100	0,000
Women	8	11,8	60	88,2	68	100	
Age							
Productive	37	32,7	76	67,3	113	100	0,094
Not Productive	3	42,8	4	57,2	7	100	
Education Level							
Low	26	30,2	60	69,8	86	100	0,352
High	14	41,2	20	58,8	34	100	
Jobs							
At Risk	23	65,7	12	34,3	35	100	0,000
Not at Risk	17	20,0	68	80,0	85	100	

Source: Primary Data, 2023

Actions result from observations, influenced by personal, social, cultural, media, educational, religious, and emotional factors. Behavior change moves from knowledge to attitude, concluding in action. The study, using the "Positive Deviance to Prevent Malaria" handbook, observed notable knowledge and attitude shifts in the intervention group, but actions did not significantly change. Short observation periods, infrequent interventions, and respondent mobility impeded action monitoring. While knowledge and attitudes improved, turning them into actions necessitates tailored interventions. Context-specific strategies are vital in malaria control programs, particularly for challenging populations.In this study, based on the identification conducted in qualitative research, 14 *positive deviance* behaviours were obtained among local residents related to malaria prevention in Jayapura City. The results of bivariate analysis of *positive deviance* behaviour and malaria incidence among local residents can be seen in Table 4 below.

Table 4. Relationship between *Positive Deviance* Variables and Malaria Incidence among Local Residents in Malaria Endemic Areas of Jayapura City in 2023

Positive Deviance	**Malaria incidence**				**Total**		***p-value***
	Yes		**No**				
	n	%	n	%	n	%	
Cleaning the Environment							
Not doing	24	61,5	15	38,5	39	100	0,000
Doing	16	19,8	65	80,2	81	100	
Burning Dry Leaves							
Not doing	11	22,0	39	78,0	50	100	1,000

Doing	29	41,4	41	58,6	70	100	
Burning Coconut Belt							
Not doing	13	22,0	46	78,0	59	100	1,000
Doing	27	44,3	34	55,7	61	100	
Anti Mosquito Lotion/Burn							
Not doing	30	46,2	35	53,8	65	100	1,000
Doing	10	18,2	45	81,8	55	100	
Telon Oil							
Not doing	28	43,1	37	56,9	65	100	0,625
Doing	12	21,8	43	78,2	55	100	
Eucalyptus Oil							
Not doing	28	52,8	25	47,2	53	100	0,012
Doing	12	17,9	55	82,1	67	100	
Pig Oil							
Not doing	25	42,4	34	57,6	59	100	0,013
Doing	15	24,6	46	75,4	61	100	
Growing Lemongrass							
Not doing	19	36,5	33	63,5	52	100	0,439
Doing	21	30,9	47	69,1	68	100	
Growing Lavender							

Not doing	17	25,8	49	74,2	66	100	
							0,332
Doing	23	42,6	31	57,4	54	100	
Sambiloto Leaf Decoction							
Not doing	29	38,2	47	61,8	76	100	
							0,005
Doing	11	25,0	33	75,0	44	100	
Green Bean Stew							
Not doing	30	40,5	44	59,5	74	100	
							0,031
Doing	10	21,7	36	78,3	46	100	
Papaya Leaf Vegetable							
Not doing	33	71,7	13	28,3	46	100	
							0,001
Doing	7	9,5	67	90,5	74	100	
Burning Egg Shells/Shells							
Not doing	18	36,0	32	64,0	50	100	
							0,681
Doing	22	31,4	48	68,6	70	100	
Long Sleeve Clothing							
Not doing	31	58,5	22	41,5	53	100	
							0,000
Doing	9	13,4	58	86,6	67	100	

Data Source: Primary Data, 2023

From Table 4, 14 Positive Deviances were identified in malaria prevention and control in Jayapura City. After analysis, it was found that 7 of them had a significant association with malaria incidence in the local population, with a p-value less than α 0.05. Positive Deviance associated with malaria incidence included routine

environmental cleaning (p-value= 0.000), using eucalyptus oil (p-value= 0.013), using pork oil (p-value= 0.013), drinking sambiloto leaf decoction (p-value= 0.005), drinking mung bean decoction (p-value= 0.031), consuming papaya leaf vegetables (p-value= 0.005), and wearing long sleeves (p-value= 0.000).

Positive Deviance activities that are not associated with malaria incidence include burning dried leaves, burning coconut belts, using anti-mosquito lotion, using telon oil, planting lemongrass, planting lavender, and burning egg shells/racks, with a p-value greater than α 0.05. These positive deviance activities are carried out by local residents to improve their immunity, health quality, and directly prevent malaria. Statistically, these efforts were shown to have an association with malaria incidence.

Multivariate Analysis

Multivariate analysis is one type of statistical analysis used to analyse data consisting of many variables, both *independent variables* and many *dependent* variables (Amirullah, 2013). Based on the results of the bivariate analysis of the relationship between the independent variables and the dependent variable, the variables that enter the multivariate analysis stage are the *Positive Deviance* variable (*p=0*.000), gender (*p=0.000)*, and occupation (*p=0*.000). The results of multivariate analysis on some of these independent variables are as follows:

Table 5. Multivariate Analysis of Research Variables in Local Residents in Malaria Endemic Areas of Jayapura City

Variables	B	SE	Wald	Sig.	Exp (B)	95% CI for Exp(B)	
						Lower	Upper
Positive Deviance	2,696	0,569	22,496	0,000	14,827	4,866	45,180

Gender	2,228	0,675	10,903	0,001	9,283	2,473	34,843
Jobs	0,036	0,675	0,003	0,958	1,036	0,276	3,895

Source: Primary Data, 2023

Table 5 shows that *Positive Deviance* is the variable that has the most dominant influence on malaria incidence, after taking into account the variables of gender and occupation, with a value of *p=0.*000 and Exp(B)=14.827 CI 95% 4.866-45.180). This means that respondents who do not do *Positive Deviance are* at risk of suffering from malaria 14.827 times compared to respondents who do *Positive Deviance*.

Phase 2 Research (Quasi-Experimental Research)

The next stage of research conducted after knowing the *Positive Deviance* that is most associated with malaria incidence, especially in terms of malaria prevention in local residents in Jayapura City, is experimental research. The research conducted is a *quasi-experimental* research (*Quasy Eksperiment*), by selecting samples non-randomly with criteria / conditions that have been determined by the researcher beforehand (*non-randomised purposive sampling*).

Multivariate analysis of the rapid survey showed that *positive deviance* variables were most associated with malaria prevention in this population. Therefore, the intervention was based on the findings of the multivariate analysis.

The experimental study involved 120 respondents consisting of 60 people in the intervention group and 60 people in the control group. The intervention group were those who based on the *screening* results in the *rapid survey* did not or rarely used eucalyptus oil, while the control group were those who had or had used eucalyptus oil as a *habbit* or habit of their lives.

Analysis of Research Variables

Differences in Knowledge of Malaria Prevention with a *Positive Deviance* Approach Before and After Intervention in Both Research Groups

The difference in knowledge of malaria prevention with a positive deviance approach before and after the intervention of providing pocket book education "*Positive Deviance to* Prevent Malaria" in both research groups can be seen in the following table:

Table 6. Differences in Knowledge of Malaria Prevention with the "*Positive Deviance to* Prevent Malaria" Approach Before and After the Intervention in Both Research Groups

Knowledge	Intervention Group (n=60)			Control Group (n=60)		
	Mean rank	**Mean Difference**	***p-value***	***Mean rank***	**Mean Difference**	***p-value***
Before	5,70			19,11		
		14,49	0,000		0,34	0,067
After	20,19			19,45		

Data Source: Primary Data, 2023

Table 6 above shows that the provision of pocket book education "*Positive Deviance to* Prevent Malaria" in the intervention group showed an effect on increasing knowledge of malaria prevention with *p value* = 0.000 < α 0.05. In the control group, the conventional intervention alone showed no effect on increasing knowledge of malaria prevention with *p value* = 0.067 > α 0.05. It can be concluded that the interventions in the two research groups are different. The intervention group has an influence on increasing knowledge of malaria prevention.

Differences in Malaria Prevention Attitudes with a *Positive Deviance* Approach Before and After the Intervention in Both Research Groups

The difference in attitudes towards malaria prevention with a positive deviance approach before and after the intervention of providing pocket book education "*Positive Deviance to* Prevent Malaria" in both research groups can be seen in the following table:

Table 7. Differences in Malaria Prevention Attitudes Using the "*Positive Deviance to* Prevent Malaria" Approach Before and After the Intervention in the Two Research Groups.

Attitude	Intervention Group (n=60)			Control Group (n=60)		
	Mean rank	**Mean Difference**	***p-value***	***Mean rank***	**Mean Difference**	***p-value***
Before	18,75	9,62	0,000	23,16	1,59	0,035
After	28,37			24,75		

Source: Primary Data, 2023

Table 7 shows that the provision of pocket book education "*Positive Deviance to* Prevent Malaria" in the intervention group showed an effect on improving attitudes towards malaria prevention with *p value* = 0.000 < α 0.05. In the control group, the conventional intervention alone also showed an effect on improving attitudes towards malaria prevention with a *p value* = 0.035 < α 0.05. It can be concluded that the intervention in both research groups has an influence on improving malaria prevention attitudes.

Differences in Malaria Prevention Actions Using the *Positive Deviance* Approach Before and After the Intervention in the Two Research Groups

The difference in malaria prevention actions with a positive deviance approach before and after the intervention of providing pocket book education "*Positive Deviance to* Prevent Malaria" in both research groups can be seen in the following table.

Table 8. Differences in Malaria Prevention Measures Using the "*Positive Deviance to* Prevent Malaria" Approach Before and After the Intervention in the Two Study Groups.

Action	Intervention Group (n=60)	Control Group (n=60)

	Mean rank	Mean Difference	*p-value*	*Mean rank*	Mean Difference	*p-value*
Before	18,72			19,65		
		6,06	0,025		0,52	0,357
After	24,78			20,17		

Source: Primary Data, 2023

Table 8 shows that the provision of pocket book education "*Positive Deviance to* Prevent Malaria" in the intervention group showed an influence on malaria prevention measures with *p value* = 0.025 < α 0.05. In the control group, the conventional intervention alone showed no effect on malaria prevention with *p value* = 0.357 > α 0.05. It can be concluded that the interventions in the two research groups are different. The intervention group had an effect on increasing malaria prevention measures.

Differences in Knowledge, Attitudes and Actions of Malaria Prevention with a *Positive Deviance* Approach in the Two Research Groups Before the Intervention

Differences in knowledge, attitudes and actions to prevent malaria before the intervention of the "*Positive Deviance* to Prevent Malaria" pocket book education in the two research groups can be seen in the following table:

Table 9. Differences in Knowledge, Attitudes and Actions to Prevent Malaria with the "*Positive Deviance to* Prevent Malaria" Approach Before the Intervention

Measured Variable	Intervention Group		Control Group		*p-value*
	n	Mean	*n*	Mean	
Knowledge	60	35,26	60	34,54	0,360
Attitude	60	35,65	60	33,45	0,234
Action	60	36,78	60	35,43	0,358

Source: Primary Data, 2023

Table 9 shows that before the intervention, there was no statistically significant difference in knowledge, attitudes and actions between the two groups. This provides information and illustrates that the knowledge, attitudes and actions of respondents in both knowledge groups are in the same condition.

Differences in Knowledge, Attitudes and Actions of Malaria Prevention with a *Positive Deviance* Approach in Both Knowledge Groups After the Intervention

Differences in knowledge, attitudes and actions to prevent malaria after the intervention in the form of pocket book education "*Positive Deviance to* Prevent Malaria" in both research groups can be seen in the following table:

Table 10: Differences in Knowledge, Attitudes and Actions to Prevent Malaria with the "*Positive Deviance* to Prevent Malaria" Approach after the Intervention.

Measured Variable	Intervention Group		Control Group		*p-value*
	n	**Mean**	***n***	**Mean**	
Knowledge	60	52,19	60	34,54	0,000
Attitude	60	38,23	60	33,45	0,013
Action	60	38,62	60	33,43	0,029

Source: Primary Data, 2023

Table 10 shows that after the intervention, it is statistically shown that there is a difference in knowledge and attitude of malaria prevention using the *Positive Deviance to* Prevent Malaria approach in both study groups because the *p-value is* less than the α value of 0.05. Table 12 also provides information that there is no difference in malaria prevention actions in the two research groups after the intervention because the *p-value is* greater than the α value of 0.05. The difference in knowledge and attitude after the intervention in both study groups indicates that the intervention provided can make this difference.

Discussion

Quantitative Research

Respondent Characteristics

There were 120 respondents involved in the quantitative research, namely *rapid survey* or rapid survey of *Positive Deviance* in local residents as an effort to accelerate malaria elimination in Jayapura City. The results of the rapid survey showed that most respondents were in the productive age group of 15-64 years old, namely 113 people (94.2%). The large number of productive-age respondents involved in this study shows that the local population, in addition to showing high mobility due to work, also informs us that this local population is also a productive population. A local population with high mobility and in the productive age group can be a potential condition for increasing the risk of malaria transmission.

The *rapid survey* conducted showed that 68 respondents (56.7%) were female, which was more than those who were male. The rapid survey results also showed that many of the respondents involved were married, 106 people (88.3%). Many respondents had completed their last education at the primary school level or equivalent, 56 people (56.7%). The marital characteristics of the respondents tell us directly that the local population group in Jayapura City at the time of the study and selected as the sample were adults and married.

Another important piece of information obtained from the rapid survey on respondents' prior knowledge of malaria was the low level of knowledge about malaria. The results of the rapid survey showed that although many had heard of malaria, many did not know about the causes, symptoms, prevention, dangers and treatment of malaria.

The low level of basic knowledge about malaria in this particular group is an obstacle in accelerating malaria elimination efforts. Win, et al in a study conducted in 2017 mentioned that treatment-seeking knowledge in this local population is a threat in the era of achieving malaria elimination [10,11].

A *cross-sectional* study conducted in Cambodia in 2019 showed that local residents are a specific group that requires a specific intervention in the country's malaria control programme. Their low knowledge of malaria prevention and transmission poses a threat to accelerating efforts to achieve malaria elimination in the country [12].

Analysing the Relationship Between Variables

***Positive Deviance* Analysis**

A rapid survey was conducted among 120 respondents in Jayapura City to obtain general information on malaria and identify Positive Deviance (PD) associated with malaria incidence, particularly in prevention and control. The results showed that of the 14 PDs identified, only 7 were associated with malaria incidence. Through qualitative research, several PDs were identified, including cleaning the environment, using pork oil, drinking boiled water of sambiloto leaves, drinking boiled water of mung beans, consuming papaya leaf vegetables, wearing long-sleeved clothes, burning dried leaves, burning coconut belts, using anti-mosquito lotion, using telon oil, using eucalyptus oil, planting lemongrass, planting lavender, and burning egg shells/racks.

The importance of environmental cleaning as a conventional measure in malaria prevention is reinforced by another study in India. In addition, the use of pork oil and eucalyptus oil is also supported by the results of analyses that show a statistical association with malaria incidence. People in Jayapura City tend to use herbal medicine as an effort to maintain immunity, following the global trend especially during the COVID-19 pandemic. The use of anti-malarial medicinal plants, as practised by the Luthya community in Kenya, also reflects positive habits in disease prevention. Although the use of herbal medicines has been widely recognised, concerns over dosage, mode of administration, toxicity and therapeutic potential remain [13]. A systematic review study showed the need for in-depth research to understand these aspects and provide sufficient information to the public [14].

The habits of the people of Jayapura City, especially in maintaining immunity and preventing malaria, are positive behaviours that can serve as examples for other groups. The rapid survey results showed a range of PD behaviours that are widely practiced by local residents related to malaria prevention and control.

Multivariate Analysis

Multivariate analysis was conducted to determine the independent variables most associated with malaria incidence among local residents in Jayapura City. The results showed that positive deviance (PD) was the most

dominant variable associated with malaria incidence. Respondents who did not practice PD had a 14.827 times higher risk of suffering from malaria compared to those who did. This finding is in line with previous research in Bulukumba which showed a significant relationship between PD and malaria incidence [15].

Positive Deviance (PD) is a community-based approach effectively tackling health and social issues by recognizing existing solutions within the community. In Jayapura City, PD is employed for malaria prevention, with practices like environmental cleanliness, mosquito net usage, burning garbage, and wearing long sleeves. Studies in Myanmar and Cambodia support these findings. Wearing long sleeves emerged as a positive behavior against nocturnal Anopheles mosquitoes, crucial in preventing malaria. Despite challenges like heat discomfort for forestry workers, awareness of protection remained high. Embracing PD as a local strategy is crucial for malaria control, representing a unique and environmentally friendly effort in Jayapura City's malaria elimination endeavors.

Quasi-Experimental Research

Respondent Characteristics

This study focused on the effect of providing health education with a pocket book entitled "Positive Deviance to Prevent Malaria" on malaria prevention knowledge among local residents in Jayapura City. The WHO identifies the productive age range as 15-64 years, and this study showed that most respondents in both study groups were within the productive age range. Health and productivity are closely linked, and Indonesian Law No 36 on Health states that productivity is an indicator of health status. Malaria can have an adverse impact on productivity and income, as seen by the loss of income due to the disease in Indonesia and Ethiopia. Gender was also found to be associated with malaria incidence in this study, and previous studies have shown an association between gender, socio-demographic variables and malaria incidence [16].

"Positive Deviance to Prevent Malaria" education significantly increased knowledge ($p=0.000$) in the intervention group, contrasting with the control group receiving conventional intervention ($p=0.067$). This underscores the effectiveness of health education in enhancing malaria prevention knowledge, consistent with other studies on media effectiveness. Recognizing the critical role of knowledge in malaria elimination, the study emphasizes

health education interventions, particularly the positive deviance approach, as crucial in addressing knowledge gaps and advancing malaria elimination efforts in Jayapura City.

The Effect of Providing "*Positive Deviance* to Prevent Malaria" Pocket Guide Education on Malaria Prevention Attitudes in Local Residents

Attitude, comprising beliefs, evaluations, and behavioral tendencies, plays a pivotal role in individual responses to stimuli. In the context of malaria prevention, attitudes drive actions. An intervention utilizing the "Positive Deviance to Prevent Malaria" pocket book was administered to both intervention and control groups, resulting in significant attitude changes in both. The intervention group, however, demonstrated more substantial improvements. The study reveals the interconnectedness of knowledge and attitude, consistent with prior research. The low knowledge and attitude levels regarding malaria prevention in Jayapura City underscore the importance of health education interventions, particularly with the Positive Deviance approach, for enhancing community awareness and acceptance. This strategy, exemplified by the pocket book, emerges as an innovative and sustainable tool in malaria control programs, especially for at-risk groups. Globally, challenges persist in populations like migrant travelers, necessitating continuous interventions. Thus, this study underscores the pivotal role of health education, particularly through positive deviance, in bolstering malaria prevention knowledge and attitudes, contributing significantly to global malaria control and elimination efforts.

The Effect of Providing "*Positive Deviance* to Prevent Malaria" Pocket Guide Education on Malaria Prevention Actions in Local Residents

Actions stem from observations and perceptions, influenced by personal, social, cultural, media, educational, religious, and emotional factors. Behavior change progresses from knowledge to attitude and culminates in action. This study, employing the "Positive Deviance to Prevent Malaria" handbook, noted significant knowledge and attitude shifts in the intervention group, but not in malaria prevention actions. Short observation periods, infrequent interventions, and respondent mobility hindered effective action monitoring. While knowledge and attitudes improved, translating these into actions requires tailored interventions, emphasizing the need for context-specific strategies in malaria control programs, especially for challenging populations.

The Positive Deviance (PD) approach to health problem solving emphasises the recognition that solutions to public health problems can be found within communities themselves. PD focuses on the power of certain individuals or groups in society who have special habits or behaviours, capable of finding better solutions to health problems.

CONCLUSION

This study shows that PD is the dominant variable in efforts to prevent malaria in Jayapura City. Positive deviance behaviour is the capital or strength that local residents have to increase endurance and maintain a healthy body during activities. Interventions in the form of education using the "Positive Deviance to Prevent Malaria" pocket book had a positive impact on knowledge and attitudes towards malaria prevention in the local population. Habits that become strengths are integrated as capital in malaria prevention, demonstrating the effectiveness of the PD approach.

In addition, the study noted that eucalyptus leaf extract has larvicidal potential against Aedes mosquito larvae, suggesting an environmentally friendly alternative in malaria control. Local residents in Jayapura City have internalised positive deviance behaviour as a habit to be maintained, especially in the context of malaria elimination. Sociodemographic factors such as gender and occupation have a significant influence on malaria incidence in Jayapura City. Interventions using a positive deviance approach through education have been shown to be effective in changing knowledge, attitudes, and actions to prevent malaria in the local population. In an effort to accelerate malaria elimination, natural and environmentally friendly approaches that involve local communities need to continue to be applied.

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