

Determinants of Delay in Treatment Seeking Among Malaria Patients in Public Health Facilities of Dambi Dollo and Sayyo District, Western Ethiopia: A Facility Based Case Control Study

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Abstract

Background: To prevent malaria from progressing to the more severe types and from increasing mortality, early and prompt treatment seeking is essential. However other investigations have shown that malaria medications were not received in the necessary amount of time. Determinants of treatment seeking delay among malaria patients must therefore be understood in order to create interventions and strategies.

Objective: The main objective of this study is to identify the determinants treatment seeking delay among malaria patients in public health facilities of Dambi Dollo and Sayyo district, Kellef Wallaga zone, Western Ethiopia, 2022.

Methods: From March 25, 2022, through May 15, 2022, a facility-based case-control research involving a sample of 322 confirmed malaria patients, 161 cases, and 161 controls was done. The study was carried out in six randomly chosen public health facilities, with a proportionate distribution of the total sample among them. Face-to-face interviews with structured and tested questionnaires were used to gather the data. EpiData version 4.4.2.1 was used to import the data, which was then exported to SPSS version 25.0 for cleaning and analysis. The causes of treatment seeking delay were determined using multivariable logistic regression analysis after bivariable analysis had been used to identify candidate factors. A p-value of 0.05 with a 95% confidence interval has been judged statistically significant. The Institutional Review Board of Dambi Dollo University's college of medicine and health sciences granted ethical approval.

Result: Patients of age <15 years of age [AOR=3.7[1.34-10.32]], Farmers in occupation [AOR=3.59[1.17-11.01]], Expensive health care costs [AOR=5.45[1.22-24.23]], Having practice of self-medication [AOR=2.01[1.10-3.67]], Previous malaria infection [AOR=1.82[1.04-3.17]], Decision made by household head [AOR=0.51[0.28-0.91]] and Waiting time at the health facility [AOR=1.91[1.19-3.24]] were found to be important determinants of treatment seeking delay among malaria patients.

Conclusion and Recommendations: It was discovered that factors such as age, occupation, health care costs, prior malaria infection, waiting period, use of self-medication, and decision-making were factors in treatment seeking delay. The two separate health offices and facilities should collaborate to provide regular health education, appropriate healthcare, and private drug shop inspections.

Key words: Treatment Seeking Delay, Malaria Patients

List of Abbreviations and Acronyms

AIDS- Acquired Immune Deficiency Virus, BF- Blood Film, CBHI-Community Based Health Insurance, CI- Confidence Interval, ETB- Ethiopian Birr FMOH- Federal Ministry of Health, HIV- Human Immune Virus, MDG-Millennium Development Goal, NMCP- National Malaria Control Program, PMI- United States, President's Malaria Initiative, RBM- Roll Back Malaria, RDT- Rapid Diagnostic Test, USD- US Dollar,

WHO- World Health Organization.

1. Introduction

A communicable disease, malaria is brought on by parasites of the Plasmodium genus and spread by female Anopheles mosquitoes [1,2]. The majority of infections in sub-Saharan Africa are caused by Plasmodium falciparum, which is the most virulent of the five Plasmodium species that infect people [3]. A significant

increase in malaria interventions during the past ten years [2001–2013] led to a 47% decrease in malaria mortality. The incidence of malaria worldwide decreased by 30% during that time. The burden of infection is still significant despite claimed drops in malaria mortality, especially in sub-Saharan Africa, which accounts for 90% of global morbidity and mortality [1, 4]. Currently, countries are attempting to control and eradicate malaria. The primary goals of these initiatives are vector control, preventive treatments, and healthcare access. Over time, the median amount of medical care sought in sub-Saharan Africa has increased, although a large percentage of febrile patients did not obtain any treatment [1]. Ethiopia is now undertaking the National Malaria Control Program [NMCP] with help from the President's Malaria Initiative of the United States [PMI]. No matter where they live, whether in malaria-endemic or malaria-free areas, the whole population of Ethiopia will have access to quick malaria diagnostic and highly effective treatment services under the NMCP 2017–2022 [5]. Research have indicated that even in the short window of time of the recommended 24 hours from the onset of malaria symptoms, delayed care seeking at health facilities was a risk factor for severe malaria. With this information, it is crucial to encourage feverish individuals to seek medical attention as soon as possible, provided that all necessary measures are taken to prevent malaria [6,7]. Additionally, despite some improvements in the accessibility of public health facilities, drug stores are still a common first choice for treating malaria symptoms, which prevents patients from seeking appropriate anti-malarial therapy by giving them false assurance and encouraging ineffective treatment [8].

The World Health Organization [WHO] has established various strategic pillars to make malaria prevention and control easier. One of these pillars, "ensuring universal access to malaria prevention, diagnosis, and treatment," calls for the quick diagnosis and treatment of those exhibiting symptoms of the disease [4, 9]. Early and effective treatment in this regard prevents illness from progressing to severe stages, which lowers the rates of mortality, morbidity, and future transmission [1]. Reducing the reservoir of malaria patients in order to lessen the likelihood of transmission of malaria in the community is another goal of early identification and treatment of patients suspected of having malaria. Within 24 hours after the development of malaria symptoms, it is advised that access to early diagnosis and rapid, effective treatment be guaranteed depending on these factors [9, 10]. One of the top 10 causes of sickness and mortality in the modern world is malaria. Malaria is one of the primary causes of mortality worldwide, although it is most prevalent in sub-Saharan Africa, where 90% of all malaria deaths occur [1, 4]. At the African summit for Roll Back Malaria [RBM] in 2010, it was decided that at least 80% of persons experiencing malaria symptoms should have quick access to and adequate treatment within 24 hours of the onset of symptoms. Yet, recent data revealed that most African nations are far from achieving this objective [2, 11]. According to Ethiopia's implementation of the NMCP 2017–2022, all suspected cases of malaria must be identified and treated within 24 hours of the onset of symptoms [5, 12]. Yet, research carried out in several regions of the country found that a relatively small percentage of patients actually sought treatment within the recommended 24

hours of the onset of symptoms [13,14]. Even among the results of research conducted in Ethiopia, the greatest percentage of malaria patients who sought treatment within 24 hours after the onset of symptoms is 52.4%, which is less than half of Ethiopia's national aim [5,15]. Several studies on the causes of delayed treatment seeking among malaria patients were conducted in Ethiopia. The majority of these research only included kids under the age of five. Although children under the age of five are among the population at risk for malaria, it is also crucial to take into account the adult population because, as of the last six years, 80% of malaria victims were adults and children aged at least five, according to Ethiopia's 2019 report [12].

Several studies have shown that treatment seeking delays are a concern, and that these delays are more severe in areas with higher malaria burdens. A shocking 100% of people who delay getting treatment for malaria do so in the East Asian region, and 79.4% of people suffer the least amount of delay [16-18]. Throughout the continent of Africa, delays in seeking treatment for malaria range from 36.6% to 87.8% [19-22]. In Ethiopia, delays in seeking treatment for malaria range from 28.7% to 52.4%, which is still well over the country's aim of 0% delay [13,15,21,23]. Several research cited socio-demographic traits, physical accessibility and environmental factors, prior experience & behavioral factors, and knowledge of malaria as factors affecting treatment seeking. They included the patient's age, sex, place of residence, marital status, level of education, family size, monthly income, knowledge of malaria, proximity to the medical institution, mode of transportation, and CBHI membership [14-17,22,24-26]. However, there are other factors known to influence early treatment seeking, including the existence of side effects, alcohol consumption, prior malaria infection, and self-medication [14,24,25,27]. However, factors relating to the healthcare system were not investigated, and it is therefore unknown whether they have an impact on the number of malaria patients who seek treatment.

More specifically, Sayyo district and Dambi Dollo town are malaria endemic areas. Recent data on the factors that influence treatment seeking delays among malaria patients can be used as an input by local NGOs, researchers, and other interested parties to plan malaria prevention and control programs in Sayyo district and Dambi Dollo town. As a result, this study has identified the factors that influence the timing of treatment requests for malaria patients who visit the public health facilities in the Dambi Dollo and Sayyo district.

In order to manage and eradicate malaria, it is crucial to have knowledge of the factors that lead to delayed treatment seeking. Consequently, the results of this study can help improve timely treatment seeking for malaria symptoms and reduce the risk of the disease progressing to a severe state and leading to death. Additionally, Kellem Wallaga Zone Health Department, Sayyo District Health Office, and Dambi Dollo Town Health Office can use the study's findings to establish and construct locally suitable plans and implementation strategies to enhance the community's prompt treatment seeking behavior. Finally, the study may be crucial in supplying details for the development of pertinent

interventional strategies by Non-Governmental Organizations [NGOs] and planners of zonal and district health programs. It may also inspire other researchers to conduct a more thorough study in this particular field.

2. Objective

To identify determinants of treatment seeking delay among malaria patients attending public health facilities of Dambi Dollo and Sayyo district from March 25, 2022 to May 15, 2022

3. Methods and Materials

3.1. Study Setting

The study was conducted in Dambi Dollo and Sayyo district. Dambi Dollo town is an administrative center and the largest town in Kellem Wallaga zone found in Sayyo district independently and it is located at 652km from Addis Ababa the capital of Ethiopia. The study area contains 7 health centers, 37 health posts 63 private health institutions and 1 comprehensive hospital. Dambi Dollo town has 3 health centers 11 health posts and about 36 private health facilities. On the other hand Dambi Dollo and Sayyo district has 4 health centers, 26 health posts and 27 private health institutions. Currently the total population of Dambi Dollo and Sayyo district is estimated to be 118040 and 123950 respectively.

3.2. Study Design and Period

Facility-based unmatched case control study was conducted from March 25, 2022 to May 15, 2022.

4. Population

4.1. Source Population

All confirmed malaria patients who seek treatment in selected public health facilities of Dambi Dollo and Sayyo district from March 25, 2022 to May 15, 2022.

4.2. Study Population

All randomly selected confirmed malaria patients who seek treatment in selected public health facilities of Dambi Dollo and Sayyo district during the data collection time.

Cases: Identified as a patient who seek treatment after 24 hours of onset of the first symptoms of malaria

Controls: Identified as a patient who seek treatment within 24 hours of onset of the first symptom of malaria

5. Eligibility Criteria

5.1. Inclusion Criteria

Those febrile patients attending the selected public health facilities and confirmed for plasmodium species by Blood film [Bf] or Rapid Diagnostic test [RDT] were enrolled in the study.

5.2. Exclusion Criteria

Those who are critically ill and with psychiatric problem were not enrolled in the study.

6. Sample Size Determination and Sampling Technique

6.1. Sample Size Determination

The sample size was determined by double population proportion formula for case control study in EpiInfo 7.0 stat calc. The calculation was computed by taking three variables; presence of side effect, knowledge on malaria and distance of the health facility which are significantly associated with treatment seeking delay in most studies. The final sample size was calculated by using the assumption of “presence of side effect” with the Odds ratio of 4.96, percent of controls exposed 2.6%, percent of cases exposed 11.7% with 95% confidence interval, power being 80%, case to control ratio of 1:1 and by adding 10% non-response rate [27]. The final sample of study participants on one to one case to control ratio became 322 with 161 cases and 161 controls. The procedure of sample size determination is shown in the table below.

Variables	CI	Power	% of controls exposed	% cases exposed	Cases to controls ratio	Odds ratio (OR)	Total sample size
Presence of side effects	95%	80%	2.6%	11.7%	1	4.96	322
Knowledge of malaria	95%	80%	34.2	51.2	1	2.02	286 (25)
Distance of the health facility	95%	80%	35.5	52.5	1	2.01	288 (27)

Table 1: Variables Used to Compute the Largest Possible Sample Size.

7. Sampling Technique

The study was carried out in 6 randomly selected public health facilities from Dambi Dollo town and Sayyo district these public health facilities which were included in the study one General Hospital and two health centers from Dambi Dollo town and three health centers from Sayyo district. Then the total sample

size was proportionally allocated to each randomly selected health facilities based on the caseloads of previous year. Cases were included by using systematic random sampling technique by calculating sampling interval [k=4] for cases based on average monthly case load of each selected health facility while controls were selected as cases were enrolled (risk set sampling).

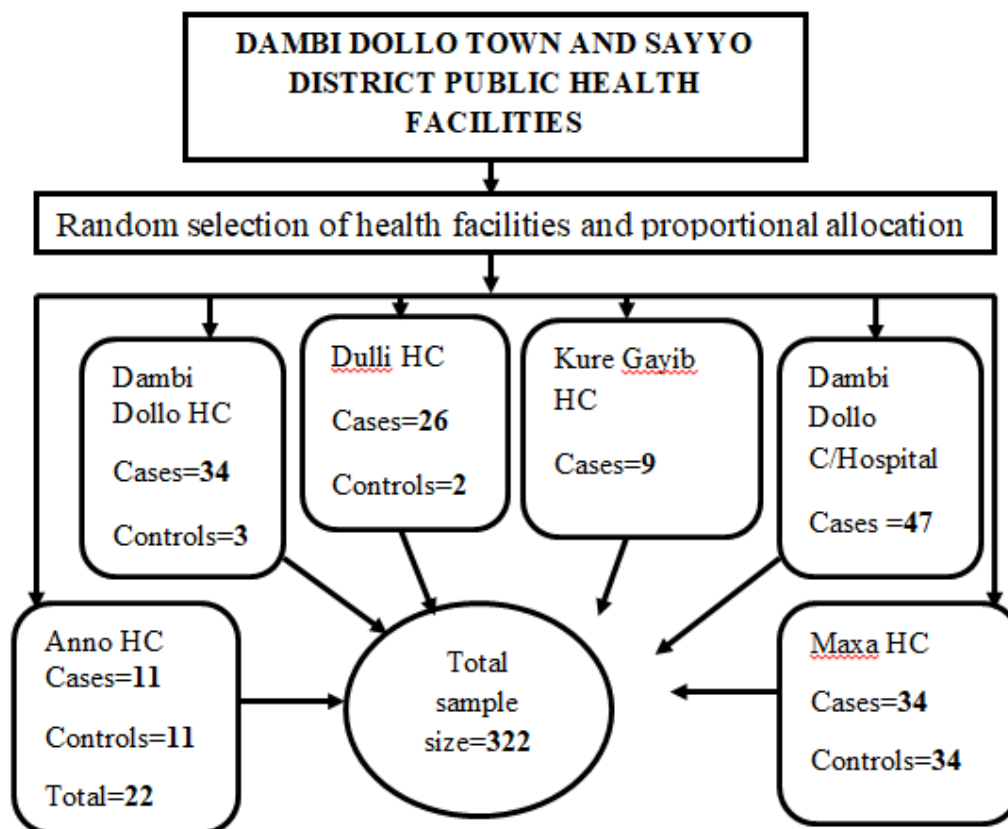


Figure 1: Schematic Representation of Sampling Procedure on Determinants of Treatment Seeking Delay among Malaria Patients in Dambi Dollo town and Sayyo District Public Health Facilities, 2022.

8. Study Variables

Dependent Variable: Treatment seeking delay among malaria patients

8. Independent Variables

Socio-Demographic Variables: Age, sex, marital status, residence, educational status, occupation, family size and average monthly income.

9. Knowledge About Malaria

Past Experience and Behavioral Factors: history of death in the family from any cause, history of malaria infection, fear of side effects, taking traditional medicine, alcohol drinking, health education and khat chewing.

Physical Accessibility and Environmental Factors: distance to health facility, transportation access, means of transportation, transportation cost, and membership of CBHI.

Health Care System Related Variables: waiting time, health care cost, shortage of drug/laboratory test, client satisfaction on health care service

10. Operational Definitions

Knowledge About Malaria: Assessed by 12 knowledge assessment questions and those who score 70% and more were considered as having good knowledge and those who score less than 70% of knowledge assessment questions were considered

as having poor knowledge [14].

Timely Treatment Seeking: is a treatment sought for symptoms malaria within 24 hours of onset of symptoms [4, 9].

Delayed treatment seeking: is a treatment sought after the recommended time of 24 hours onset of malaria symptoms [4, 9].

Client Satisfaction on Health Care Service: was measured by clients' responses on 16 likert-scale questions which range from 1 (strongly disagree) to 5 (strongly agree). Then the percentage score was computed patients who scored 75% and above were considered as satisfied and those who scored less than 75% were considered as unsatisfied [29].

11. Data Collection Tool and Procedure

Data were gathered using a standardized, beforehand tested questionnaire that was created after analyzing several peer-reviewed literatures [14, 25, 27, 29-31]. The measure includes questions about client satisfaction, treatment seeking delay, knowledge assessment, physical accessibility and environmental variables, behavioral factors, and treatment seeking factors. Also, 12 closed-ended, multiple-choice questions with a maximum score of 1 point were adapted from a prior study's knowledge assessment questions on malaria's signs and symptoms, transmission, and prevention [30, 31]. A client satisfaction assessment tool that includes 16 likert scale items about staff

behavior and services, physical facilities and surroundings, and accessibility and availability of health care services was also taken from peer-reviewed research [29]. The survey was first written in English before being translated into Afaan Oromoo.

Data was gathered by interviewers who provided questionnaires to patients and carers after the patients' diagnoses and confirmations by the clinicians and other healthcare professionals in the medical facilities. Four health officers oversaw the data gathering process while seven clinical nurses in the health centers and one Bsc nurse in Dambi Dollo Comprehensive Hospital collected the information. Participants in the data collection session received advice on COVID-19 preventive strategies. In addition, both data collectors and study participants used personal safety techniques such washing their hands, covering their faces, and keeping a physical distance.

12. Data Quality Assurance

In order to ensure the quality of the data, data supervisors and collectors were chosen from among the medical staff at the corresponding healthcare facilities. Eight cases and eight controls were used to pre-test the produced tool on 16 patients with confirmed malaria [5% of the sample]. After that, a reliability test was conducted, and adjustments were made as necessary. To further assure data completeness, supervisors and the lead investigator cross-checked completed surveys each day. Data was cleaned to remove glaring data entry errors, and variables were created to make the data more consistent.

13. Data Processing and Analysis

The collected information was verified for accuracy and consistency before being entered into EpiData version 4.4.2.1 and exported to SPSS version 25.0 for data cleaning and analysis. To describe the research population in relation to important variables and show the information in tables, frequencies, proportions, charts, and summary statistics were employed. To find potential variables for multivariable logistic regression, bivariate analysis was used. In order to ascertain the relationship between the dependent and independent variables and to mitigate the effect of confounders on treatment seeking delay, factors with a p-value of less than 0.25 in bivariate analysis were added to the final multivariable logistic regression model. Multicollinearity could not be found. Model fitness was examined using the Hosmer and Lemshow goodness-of-fit test. Finally variables whose p value less than 0.05 [$p < 0.05$] with 95% CI in multivariable logistic regression were considered as having statistically significant association.

14. Ethical Consideration

The Institutional Review Board of Dambi Dollo University's Institute of Health Science granted ethical approval. Upon

acceptance, the Dambi Dollo University School of Public Health sent an official letter of cooperation to the relevant organizations. The Dambi Dollo town health office, the Sayyo district health office, and the respective medical facilities where the data collection was done all gave their consent. Each respondent verbally agreed to participate in the study after being told of its goal and purpose, and participants under the age of 18 need the approval of their parents or legal guardians. Respondents were provided clear information about the study's goal and methodology, the value of their involvement, and their right to withdraw at any moment if they so desired. Additionally, by retaining anonymity, interviewing them in a different room throughout the interview, and locking obtained data, the respondents were made fully aware of their privacy and confidentiality throughout the study.

15. Dissemination of Results

The final research findings will be presented Institute of Health Science at Dambi Dollo University. The research findings will also be communicated to the Sayyo district health office, Dambi Dollo town health unit, and other relevant authorities at various administrative levels to enable them to take recommendations into account during their planning process. The results will then be discussed in scientific forums, conferences, seminars, and other professional gatherings. An effort will also be made to publish the findings in a peer-reviewed journal.

16. Results

16.1. Socio-Demographic Characteristics

A total of 322[161 cases and 161 controls] participants were included in the study with 100% response rate. The age range in cases group was 4-62 years with mean[\pm SD] age of 26.26[\pm 13.09] years, while the age of study participants ranges from 4-60 years in control group with mean[\pm SD] age of 27.55[\pm 11.8] years. About 59.6% and 55.3% participants were males in cases and controls respectively. More than half [54.7%] of the participants were from rural residence while the remaining 45.3% being from urban residence. Regarding marital status of the participants 44.1% were married, 53.1% were never married and only 2.8% were divorced and widowed. About 59(36.6%) and 39(24.2%) of cases have attended primary school and secondary school respectively while among controls those attended primary and secondary school were 63(39.1%) and 42(26.1%) respectively. Besides these, 23% of cases and 19.9% of controls never had formal education. Related to the occupation of the participants 29.2% cases and 25.5% of controls were students; 18.9% of cases and 8.1% of cases were farmers. Family size of the participants was ≥ 5 members in 57.8% of cases and 58.4% in controls. Majority of cases (68.3%) and controls (69.6%) earn >1000ETB per month.

Variables		Patient category			
		Controls=161		Cases=161	
		No	%	No	%
Residence	Urban	68	42.2	78	48.4
	Rural	93	57.8	83	51.6

Age	<15	29	18	14	8.7
	15-29	75	46.6	82	50.9
	≥30	57	35.4	65	40.4
Sex	Male	96	59.6	89	55.3
	Female	65	40.4	72	44.7
Marital status	Married	67	41.6	75	46.6
	Never married	86	53.4	85	52.8
	Divorced and Widowed	8	5	1	0.6
Educational status	No formal education	32	19.9	37	23
	Primary school	63	39.1	59	36.6
	Secondary school	42	26.1	39	24.2
	College and above	24	14.9	26	16.1
Occupation	Government employee	16	9.9	21	13
	Merchant	35	21.7	30	18.6
	Housewife	17	10.6	24	14.9
	Farmer	30	18.9	13	8.1
	Self-employed/daily	16	9.9	32	19.9
	Student	47	29.2	41	25.5
Monthly income	<500ETB	5	3.1	3	1.9
	500-1000ETB	46	28.6	46	28.6
	>1000ETB	110	68.3	110	68.3
Family size	<5	67	41.6	68	42.2
	≥5	94	58.4	93	57.8

Table 2: Socio-Demographic Characteristics of Malaria Patients in Public Health Facilities of Dambi Dollo and Sayyo District, Western Ethiopia, 2022 (n=322).

17. Past Experience and Behavioral Factors

Among the study participants 39(24.2%) of cases and 27(16.8%) of controls have reported a death of a family member related to any cause in the last 1 year. Majority of cases (90.1%) and controls [88.8%] reported a health facility as their place to seek

treatment for malaria. About quarter 75.2% of cases and 56.5% of controls had a practice of self-medication. Decision made by the household head for seeking treatment for malaria was 54.7% and 62.7% in cases and controls respectively.

Variables	Patient category				
	Cases=161		Controls=161		
	No	%	No	%	
Death due to any cause in the family in last 1 year					
	Yes	39	24.2	27	16.8
	No	122	75.8	134	83.2
Malaria treatments have side effects					
	Yes	80	49.7	85	52.8
	No	81	50.3	76	47.2
First place to seek treatment for malaria					
	Health facility	45	90.1	143	88.8
	Drug vendor	11	6.8	14	8.7
	Traditional healing	5	3.1	2	1.2

	Religious healing	-		2	1.2
Use traditional medicine					
	Yes	33	20.5	43	26.7
	No	128	79.5	118	73.3
Practice of self-medication					
	Yes	121	75.2	91	56.5
	No	40	24.8	70	43.5
Previous malaria infection					
	Yes	121	75.2	102	63.4
	No	40	24.8	59	36.6
Decision making					
	Head of household	88	54.7	101	62.7
	Patient	73	45.3	60	37.3
Drink alcohol					
	Yes	10	6.2	16	9.9
	No	151	93.8	145	90.1
Chew khat					
	Yes	2	1.2	9	5.9
	No	159	98.8	152	94.4
Had health education					
	Yes	108	67.1	107	66.5
	No	53	32.9	54	33.5

Table 3: Behavioral Factors of Treatment Seeking Delay Among Malaria Patients in Public Health Facilities of Dambi Dollo and Sayyo District, Western Ethiopia, 2022.

18. Knowledge about Malaria

The knowledge about malaria was found to be poor in 82% of cases and 87% of controls.

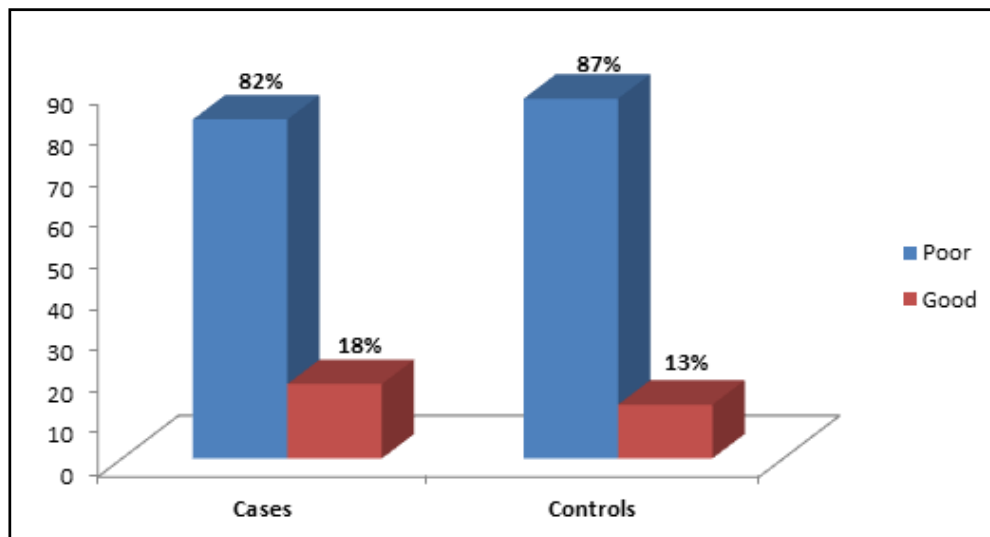


Figure 2: Figure Showing Proportions of Knowledge among about Malaria among Malaria Patients in Public Health Facilities of Dambi Dollo Town and Sayyo District, 2022.

19. Physical Accessibility and Environmental Factors

The time to the nearest health facility was <30 minutes of walk for 84(52.5%) cases and 86(53.4%) controls. About 78.9% of cases and 78.3% controls reported the transportation is accessible

in their locality while 55[34.2%] cases and 63(39.1%) controls thought that the cost of transportation was expensive. According to the finding 67(41.6%) cases and 59(36.6%) controls were members of CBHI.

Variables	Patient category				
	Cases =161		Controls=161		
	No	%	No	%	
Distance from the nearest health facility					
	<30 minutes	84	52.2	86	53.4
	≥30 minutes	77	47.8	75	46.6
Transportation access					
	Yes	127	78.9	126	78.3
	No	34	21.1	35	21.7
Cost of transportation					
	Expensive	60	37.3	74	46
	Not expensive	60	37.3	52	32.3
	No fee	41	25.5	35	21.7
CBHI membership					
	Yes	67	41.6	59	36.6
	No	94	58.4	102	63.4

Table 4: Physical Accessibility and Environmental Factors of Treatment Seeking Delay among Malaria Patients in Public Health Facilities of Dambi Dollo and Sayyo District, Western Ethiopia, 2022 (n=322)

20. Health Care System Related Factors

Among the study participants 30(18.6%)cases and 35(21.7) controls were not satisfied with the service provided. Majority of cases (82.6%) of cases and 80.1% of controls have responded that the health care cost for malaria was not expensive. On the

other hand 40(27.3%) cases and 27(16.8%) controls revealed that they had experienced a shortage of drugs/laboratory tests in their previous visit to the health facility. Waiting time at the health facility was reported as long by more than half of cases (56.5%) and 42.2% of controls.

Variables		Category of patients			
		Cases=161		Controls =161	
		No	%	No	%
Client satisfaction					
	Not satisfied	30	18.6	35	21.7
	Satisfied	131	81.4	126	78.3
Health care cost for malaria treatment					
	Expensive	11	6.8	4	2.5
	Not expensive	133	82.6	129	80.1
	No fee	17	10.6	28	17.4
Waiting time					
	Long	91	56.5	68	42.2
	Not long	70	43.5	93	57.8
Experience of shortage of drugs/laboratory tests					
	Yes	44	27.3	27	16.8
	No	117	72.7	134	83.2

Table 5: Health Care Related Factors of Treatment Seeking Delay among Malaria Patients in Public Health Facilities of Dambi Dollo and Sayyo District, Western Ethiopia, 2022 (n=322).

21. Reasons for Delay Among Cases

Majority, 101(62.7%) cases were late to seek treatment because the disease was not sever enough. About 13.7% of cases delayed to seek treatment for malaria due to lack of money. Other rea-

sons for the delay were fear of cost of health care (6.2%), lack of transportation access (8.7%), bought medication from drug vendor (3.7%), taking traditional medicine (1.9), home treatment (1.2%), and some other reasons (1.9%).

22. Determinants of Treatment Seeking Delay among Malaria Patients.

22.1. Bivariable and Multivariable Logistic Regression Results

In bivariable logistic regression analysis variables with p-value <0.25 were considered as candidates for multivariable logistic regression. Accordingly; socio-demographic variables (age, marital status and occupation), past experience and behavioral

factors (history of death in the family, use of traditional medicine, practice of self-medication, previous malaria infection, alcohol drinking and khat chewing), physical accessibility and environmental factors (cost of transportation), health care system related factors (health care cost, waiting time and shortage of drugs/laboratory tests) and knowledge about malaria were identified as candidates for multivariable logistic regression.

Variables		Cases=161 No(%)	Controls=161 No(%)	COR(95% CI)	P-value
Residence					
	Urban	68(42.2)	78(48.4)	0.77(0.5,1.2)	0.26
	Rural	93(57.8)	83(51.6)	1	
Age					
	<15	29(18)	14(8.7)	2.36(1.13,4.90)	0.021
	15-29	75(46.6)	82(50.9)	1.04(0.64,1.67)	0.862
	≥30	57(35.4)	65(40.4)	1	
Sex					
	Male	96(59.6)	89(55.3)	1.19(0.76,1.85)	0.43
	Female	65(40.4)	72(44.7)	1	
Marital status					
	Married	67(41.6)	75(46.6)	0.11(0.01,0.91)	0.04
	Never married	86(53.4)	85(52.8)	0.12(0.01,1.03)	0.05
	DW	8(5)	1(0.6)	1	
Educational status					
	No formal education	32(19.9)	37(23)	0.93(0.45,1.94)	0.86
	Primary school	63(39.1)	59(36.6)	1.15(0.59,2.23)	0.66
	Secondary school	42(26.1)	39(24.2)	1.16(0.57,2.36)	0.67
	College and above	24(14.9)	26(16.1)	1	
Occupation					
	Government employee	16(9.9)	21(13)	0.66(0.30,1.44)	0.301
	Merchant	35(21.7)	30(18.6)	1.01(0.53,1.93)	0.957
	Housewife	17(10.6)	24(14.9)	0.61(0.29,1.30)	0.208
	Farmer	30(18.9)	13(8.1)	2.01(0.92,4.36)	0.076
	Self-employed	16(9.9)	32(19.9)	0.43(0.21,0.90)	0.026
	Student	47(29.2)	41(25.5)	1	
Monthly income					
	<500ETB	5(3.1)	3(1.9)	1.69(0.39,7.27)	0.47
	500-1000ETB	46(28.6)	46(28.6)	1.01(0.62,1.65)	0.94
	>1000ETB	110(68.3)	112(69.6)	1	
Family size					
	<5	67(41.6)	68(42.2)	1.02(0.65,1.59)	0.91
	≥5	94(58.4)	93(57.8)	1	
Death due to any cause in the family in last 1 year					
	Yes	39(24.2)	27(16.8)	1.58(0.91,2.74)	0.099
	No	122(75.8)	134(83.2)	1	
Health care cost for malaria treatment					
	Expensive	11(6.8)	4(2.5)	4.52(1.24,16.5)	0.022
	Not expensive	133(82.6)	129(80.1)	1.69(0.88,3.25)	0.11

	No fee	17(10.6)	28(17.4)	1	
Use traditional medicine					
	Yes	33(20.5)	43(26.7)	0.70(0.42,1.18)	0.19
	No	128(79.5)	118(73.3)	1	
Practice of self-medication					
	Yes	121(75.2)	91(56.5)	2.32(1.44,3.73)	0.000
	No	40(24.8)	70(43.5)	1	
Previous malaria infection					
	Yes	121(75.2)	102(63.4)	1.75(1.08,2.82)	0.02
	No	40(24.8)	59(36.6)	1	
Decision making					
	Head of household	88(54.7)	101(62.7)	0.71(0.45,1.11)	0.142
	Patient	73(45.3)	60(37.3)	1	
Drink alcohol					
	Yes	10(6.2)	16(9.9)	0.6(0.26,1.36)	0.224
	No	151(93.8)	145(90.1)	1	
Chew khat					
	Yes	2(1.2)	9(5.9)	0.21(0.04,0.99)	0.05
	No	159(98.8)	152(94.4)	1	
Knowledge about malaria					
	Poor	132(82)	140(87)	0.68(0.37,1.25)	0.22
	Good	29(18)	21(13)	1	
Distance to the nearest health facility					
	<30 minutes	84(52.2)	86(53.4)	0.95(0.61,1.47)	0.82
	≥30 minutes	77(47.8)	75(46.6)	1	
Cost of transportation					
	Expensive	60(37.3)	74(46)	0.69(0.39,1.21)	0.202
	Not expensive	60(37.3)	52(32.3)	0.98(0.54,1.76)	
	No fee	41(25.5)	35(21.7)	1	
CBHI					
	Yes	67(41.6)	59(36.6)	1.23(0.78,1.92)	0.36
	No	94(58.4)	102(63.4)	1	
Health education					
	Yes	108(67.1)	107(66.5)	1.03(0.64,1.63)	0.91
	No	53(32.9)	54(33.5)	1	
Client satisfaction					
	Not satisfied	30(18.6)	35(21.7)	0.82(0.47,1.42)	0.48
	Satisfied	131(81.4)	126(78.3)	1	
Waiting time					
	Long	91(56.5)	68(42.2)	1.77(1.14,2.76)	0.011
	Not long	70(43.5)	93(57.8)	1	
Experience of shortage of drugs/laboratory tests					
	Yes	44(27.3)	27(16.8)	1.86(1.08,3.20)	0.023
	No	117(72.7)	134(83.2)	1	

DW=Divorced and Widowed

Table 6: Bivariate Logistic Regression Result of Determinants of Treatment Seeking Delay among Malaria Patients in Public Health Facilities of Dambi Dollo and Sayyo District, Western Ethiopia, 2022.

Multivariable logistic regression analysis results have identified that different factors have been significantly associated with treatment seeking delay among malaria patients. Accordingly age, occupation, health care cost for malaria treatment, practice of self-medication, previous malaria infection, decision making, & waiting time were found to have significant association with treatment seeking delay. Patients of <15 years are about four times more likely to delay in treatment seeking when compared to patients of age ≥30 years (AOR=3.7, 95%CI:1.34-10.32). Farmers are about four times more likely to delay than students in occupation (AOR=3.59, 95%CI: 1.17-11.01). Those who thought that the health care cost for malaria treatment is expensive were five times more likely to delay when compared

to those who did not pay (AOR=5.45, 95%CI: 1.22-24.23). Patients with practice of self-medication were twice more likely to delay when compared to their counter parts (AOR=2.01, 1.10-3.67). Malaria patients with the history of previous malaria infection were found to be two times more likely to delay than those with no previous malaria infection, (AOR=1.82, 95%CI: 1.04-3.17). Delay is 49% less likely to happen in those patients where household head makes decision to seek treatment for malaria when compared to those who decided by themselves, (AOR=0.51, 95%CI: 0.28-0.91). Patients with long waiting time during prior visits were found to be two times more likely to delay relative to those with not long waiting time, (AOR=1.91, 95%CI: 1.19-3.24).

Variables	Cases=161	Controls=161	COR(95% CI)	AOR(95%CI)	
	No (%)	No (%)			
Age					
	<15	29(18)	14(8.7)	2.36(1.13-4.90)	3.7(1.34-10.32)*
	15-29	75(46.6)	82(50.9)	1.04(0.64-1.67)	1.35(0.68-2.66)
	≥30	57(35.4)	65(40.4)	1	1
Marital status					
	Married	67(41.6)	75(46.6)	0.11(0.01-0.91)	0.24(0.02-2.01)
	Never married	86(53.4)	85(52.8)	0.12(0.01-1.03)	0.22(0.02-2.19)
	DW	8(5)	1(0.6)	1	1
Occupation					
	Government employee	16(9.9)	21(13)	0.66(0.30-1.44)	0.67(0.24-1.84)
	Merchant	35(21.7)	30(18.6)	1.01(0.53-1.93)	1.15(0.50-2.63)
	Housewife	17(10.6)	24(14.9)	0.61(0.29-1.30)	0.97(0.35-2.77)
	Farmer	30(18.9)	13(8.1)	2.01(0.92-4.36)	3.59(1.17-11.01)*
	Self-employed	16(9.9)	32(19.9)	0.43(0.21-0.90)	0.61(0.26-1.44)
	Student	47(29.2)	41(25.5)	1	1
Death due to any cause in the family in last 1 year					
	Yes	39(24.2)	27(16.8)	1.58(0.91-2.74)	1.26(0.66-2.38)
	No	122(75.8)	134(83.2)	1	1
Health care cost for malaria treatment					
	Expensive	11(6.8)	4(2.5)	4.52(1.24-16.5)	5.45(1.22-24.23)*
	Not expensive	133(82.6)	129(80.1)	1.69(0.88-3.25)	2.04(0.92-4.50)
	No fee	17(10.6)	28(17.4)	1	1
Use traditional medicine					
	Yes	33(20.5)	43(26.7)	0.70(0.42-1.18)	0.88(0.44-1.72)
	No	128(79.5)	118(73.3)	1	1
Practice of self-medication					
	Yes	121(75.2)	91(56.5)	2.32(1.44-3.73)	2.01(1.10-3.67)*
	No	40(24.8)	70(43.5)	1	1
Previous malaria infection					
	Yes	121(75.2)	102(63.4)	1.75(1.08-2.82)	1.82(1.04-3.17)*
	No	40(24.8)	59(36.6)	1	1
Decision making					
	Head of HH	88(54.7)	101(62.7)	0.71(0.45-1.11)	0.51(0.28-0.91)*

	Patient	73(45.3)	60(37.3)	1	1
Drink alcohol					
	Yes	10(6.2)	16(9.9)	0.6(0.26-1.36)	0.65(0.22-1.86)
	No	151(93.8)	145(90.1)	1	1
Chew khat					
	Yes	2(1.2)	9(5.9)	0.21(0.04-0.99)	0.25(0.04-1.45)
	No	159(98.8)	152(94.4)	1	1
Knowledge about malaria					
	Poor	132(82)	140(87)	0.68(0.37-1.25)	0.86(0.40-1.74)
	Good	29(18)	21(13)	1	1
Cost of transportation					
	Expensive	60(37.3)	74(46)	0.69(0.39-1.21)	0.85(0.43-1.65)
	Not expensive	60(37.3)	52(32.3)	0.98(0.54-1.76)	1.09(0.53-2.22)
	No fee	41(25.5)	35(21.7)	1	1
Waiting time					
	Long	91(56.5)	68(42.2)	1.77(1.14-2.76)	1.91(1.19-3.24)*
	Not long	70(43.5)	93(57.8)	1	1
Experience of shortage of drugs/laboratory tests					
	Yes	44(27.3)	27(16.8)	1.86(1.08-3.20)	1.64(0.87-3.11)
	No	117(72.7)	134(83.2)	1	1

*indicates significance at $p < 0.05$, DW

Table 7: Multivariable Logistic Regression Result on Determinants of Treatment Seeking Delay among Malaria Patients in Public Health Facilities of Dambi Dollo and Sayyo District, Western Ethiopia, 2022.

23. Discussion

Delays in seeking treatment can be caused by a variety of factors, including socioeconomic and demographic characteristics, patient behaviors, physical accessibility, environmental factors, health care system-related issues, and environmental factors [25, 27]. This study found a significant relationship between the patient's age, occupation, the cost of medical care for treating malaria, the use of self-medication, a history of malaria infection, the person making the decision to seek treatment, and the length of time spent waiting in the medical facility.

The age of the patient was discovered to be a significant predictor of delayed treatment seeking among malaria patients. Patients under the age of 15 were more likely to put off getting treatment for malaria, according to this study's findings. Younger children may find it difficult to understand and articulate how serious a sickness is, which causes parents to wait until their own children can recognize the disease and its severity, at which point they will seek medical attention. The findings of the study in Myanmar also corroborate this conclusion. [16, 17].

The occupation of malaria patients in the medical facilities was also discovered to be a significant factor in treatment delays. In their line of work, farmers were more likely to put off getting the malaria treatment they needed. Its significance may result from the fact that farmers may be preoccupied with their regular farm tasks designed to produce cash. The investigation carried out in northwest Ethiopia reported the same results [14]. Also,

they might have had trouble paying for their transportation and medical expenses. This study's findings are comparable with similar findings from studies done elsewhere, which indicated that patients who worked in agriculture delayed seeking treatment for malaria [17]. Self-medication is strongly correlated with delayed treatment seeking among malaria patients. When compared to those who did not practice self-medication, those who did so were more likely to put off getting treatment for malaria. The fact that 3.7% of cases were delayed because a patient purchased a drug from a drug store is proof that people who take medications without a doctor's prescription prefer to attend drug vendors and pharmacy stores over healthcare facilities for necessary laboratory tests and treatments. This may also be due to the ease of access and the perception that drug stores have an adequate supply of medications [32]. This result is similarly consistent with research from the People's Democratic Republic of Loas, which found that community usage of medication for minor symptoms without a doctor's advice was common [33].

A key determining factor for treatment-seeking delays among malaria patients in this study is prior malaria infection. Likewise, it was discovered that patients who had previously contracted malaria were more prone to put off getting treatment. This result concurs with the research's findings from northwest Ethiopia. This can be because people think they have a little illness, or it might be because they can't tell the difference between malaria and other feverish infections. A lack of funds could also result from previous medical expenses. [15].

Another important determinant element with a strong correlation to treatment seeking delay is who decides to seek treatment for malaria. As a result, seeking early treatment was more likely when the decision was made by the head of the household than when it was made by the individual. This result is in line with the results of a research conducted in northern Ethiopia [25]. Nevertheless, it is not consistent with a study from northwest Ethiopia that found that the longer people wait to get care, the more decisions they make [14]. The current study is also in contrast to one done in Uganda, where household head and parent consultations delayed younger children from obtaining treatment for malaria. The older parents' perception that the ailments could be caused by witchcraft and their preference for herbal remedies were also underlined by this study [32]. The variances in the results may be the result of regional and cultural variations.

The expense of medical care for treating malaria was a significant factor in the delay in seeking treatment. Individuals who rated the expense of health care as high were more likely to put off getting treated for malaria. The study's finding that 13.7% of patients delayed seeking treatment because they couldn't afford it suggests that people may not have enough money to cover the expense of therapy. Research results from Loas also corroborate recent findings that people choose to buy drugs without a doctor's prescription due to the high expenditures of visiting district hospitals and health centers [33]. Another factor that contributed to the delay in malaria patients seeking treatment was the length of time they had to wait at the health center to receive the services on their last visit. Patients who had to wait a long time at the medical institutions to receive care were more inclined to put off seeking treatment. This importance may be due to the fact that patients who experienced lengthy wait times to receive services during a previous visit may believe that the wait times will continue to be lengthy. This significance was further supported by a qualitative study conducted elsewhere that examined how malaria patients were deterred from visiting public health facilities early because of the need to wait in line for services at each point of service delivery. [34, 35].

24. Limitation

24.1. Limitation

- There could be a recall bias since some questions were asked about previous happenings. In order to reduce this bias, respondents were asked responses within the defined time period.
- There could also be a selection bias while classifying the study participants as cases and controls since they may be unable to clearly indicate the exact time of onset of symptoms.

25. Conclusion

Age under 15 years old, farmer occupation, high health care prices, self-medication practice, prior malaria infection, and lengthy wait times in the health facility were discovered to be major drivers of treatment seeking delay in this study. Most importantly, the household head's decisions have a preventing influence on malaria patients delaying treatment.

Recommendations

Recommendations for Health Facilities

- Patients with malaria should be advised that they may contract the disease again, so they should seek medical attention as soon as symptoms occur.
- Health facilities should take steps to reduce healthcare costs in coordination with all relevant organizations.
- In order to encourage early care seeking, the length of time patients must wait in healthcare institutions should be cut down.

Recommendations for Dambi Dollo Town and Sayyo District Health Offices

- Little children should receive special attention in order to encourage them to seek out malaria therapy.
- Drug vendors must be inspected because they often sell medications without conventional prescriptions, so an intervention is needed to reduce the use of self-medication.

Recommendations for Researchers

- The next time, researchers should think about performing a qualitative study with patients.

Declarations

Ethics Approval and Consent to Participate

All methods of this study were carried out under the Declaration of Helsinki's ethical principle for medical research involving human subjects. Ethical approval to conduct this study was obtained from the ethical review committee of Dambi Dollo University, Institute of Health Science (Ref. No: DaDU/IHS/PH/23/2022). An official letter was sent to the Dambi Dollo town and Sayyo District Administration Office. Permission letter was delivered to district administration office. Then district administration office sent supportive letter to respective Health institutions. For the study participant informed consent was obtained. Confidentiality and privacy of the information was maintained. The respondents were informed that participation is voluntary.

Consent for Publication

- Not applicable

Availability of Data and Materials

- The data and all supporting materials used in the preparation of this manuscript are freely available from the corresponding author at reasonable request.

Conflict of Interest

- The authors declare that they have no competing interests for the publication of this study.

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Authors' Contributions

• CJG conceived the research idea; CJG and SMT performed research design, data collection, data analysis, and report writing. CJG writes the original drafts of the manuscript. All authors critically reviewed and approved the final version of the manuscript.

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