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**KNOWLEDGE, ATTITUDE AND PRACTICE TOWARDS MALARIA
PREVENTION AND MANAGEMENT AMONG ADULTS PEOPLE AGED
BETWEEN (18-65) YEARS RESIDENT IN GASABO DISTRICT, KIGALI
CITY, RWANDA.**

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Abstract

Malaria continues to remain a major health problem in Gasabo district and Rwanda at large despite of various measures that have been geared towards treatment and management of the disease. The present study is aimed to investigate Gasabo district community's knowledge, attitudes and practices in relation to malaria prevention and management, Rwanda. The study assesses the knowledge, attitudes and practices towards malaria prevention and management in Gasabo district, Rwanda. This knowledge provided information which is used in the formulation of effective and appropriate management strategies to reduce malaria transmission in the district. Understanding the local knowledge, attitudes and practices towards malaria transmission in Gasabo is of great importance to health planners, policy makers and the public in general in terms of the formulation of an integrated management strategy for malaria management in the study area. This is categorically critical as the future plans are to eliminate the malaria transmissions, and these should be linked with understanding of the dynamics of malaria transmission and malarial risk factors, which ranges from environmental to non-environmental factors. A community-based cross-sectional survey was conducted among 400 adults' people living in the Gasabo district. A multistage random sampling technique was used to select households. An electronic questionnaire developed on Open Data Kit (ODK), was used to collect data on socio-demographic characteristics, household assets, people' knowledge of malaria, as well as their attitudes with regards to malaria prevention, and care-seeking behaviors. The study in Gasabo District revealed that 50% of respondents exhibited high knowledge of malaria, while 32.5% had moderate knowledge, and 17.5% had low knowledge. Positive attitudes towards malaria prevention were predominant, with 68.25% of respondents showing supportive attitudes. However, 31.75% exhibited negative attitudes. Practices towards malaria prevention were mixed; 53.75% of households reported a malaria case, and 47.75% sought professional medical help, while 19.75% resorted to self-medication. Personal protective measures were inconsistently applied, with significant variations in the frequency of use. Overall, 54.39% demonstrated fair preventive practices, 19.43% good practices, and 26.18% poor practices, indicating a need for enhanced educational efforts and healthcare access.

Key words: KAP, Malaria, Prevention, Management, Adult People

1. Introduction

Malaria is one of the most deadliest infectious disease, with an estimated 229 million cases and 409,000 deaths worldwide in 2019 (Imboumy-Limoukou et al., 2020). According to Limoukou et al (Imboumy-Limoukou et al., 2020), children under the age of five accounted for 67% (274,000) of all malaria fatalities worldwide. The global fight against malaria is a complex tapestry woven with threads of diverse knowledge levels, attitudes, and practices. A myriad of studies conducted globally has shed light on this intricate landscape. A comprehensive analysis by Anene-Okeke et al. (2018) highlights varying levels of knowledge about malaria transmission and prevention across different regions. While some communities exhibit commendable awareness, others grapple with persistent misconceptions. A study by Badu et al. (2023) underscores the role of cultural beliefs and socio-economic factors in shaping attitudes. A systematic review by Fernando et al. (2018) indicates that despite awareness, inconsistent adherence to preventive measures, incomplete treatment courses, and delayed healthcare-seeking behaviors persist. Successful interventions often hinge on culturally sensitive strategies and community engagement.

The African Region of the World Health Organization (WHO) bears a disproportionately large share of the global malaria burden, accounting for 94% of malaria cases and fatalities in 2019 (WHO, 2020).

Several studies conducted in Sub-Saharan Africa demonstrate the wide range of knowledge levels. Disparities are shown by Nneka and Okagua(2019), who highlight the significance of modifying interventions to target particular community perceptions. According to research by Addis and Wondmeneh (2020), expanding access to healthcare services and supporting community-driven initiatives are important ways to cultivate positive attitudes. It is essential to provide communities the authority to take charge of preventive measures. In sub-Saharan Africa, cultural norms, healthcare accessibility, and poverty all have an impact on the diversity of practices. This study emphasizes the significance of socioeconomic factors, community-based initiatives, and incorporating malaria prevention into mother and child health programmes for best practices.

Rwanda, is reflected in high levels of knowledge, attributed to robust health education programs and community outreach initiatives (Nsanjabana et al., 2019). Positive attitudes towards malaria prevention are evident in the widespread acceptance and utilization of preventive tools such as

long-lasting insecticidal net. Rwanda's success in bridging the knowledge-practice gap is highlighted by consistent practices such as high bed net ownership and utilization rates. Studies by Nsanzabana et al. (2018) emphasize the integration of malaria prevention into routine healthcare services and community-based distribution of preventive tools. However, starting from 2012 to 2017, Rwanda experienced a resurgence in malaria cases. During this period, there was an increase in the presence of malaria parasites in the blood of children under the age of five, rising from 1 percent in 2010 to 7 percent in 2021. Furthermore, the incidence of malaria increased to 48 cases per 1,000 individuals (PMI, 2022). Previous research does not have sufficiently explored the effectiveness of current interventions or the impact of recent public health campaigns in Gasabo District.

Therefore, malaria, a preventable, treatable, and curable disease, is endemic in Rwanda and remains one of the foremost public health problems in the country, taking its greatest toll on children under age 5 and pregnant women (RDHS 2019/2020). In 2019, an estimated 229 million malaria cases and 409,000 malaria-related deaths occurred worldwide which make it significant global health burden. Malaria-related morbidity and mortality contribute to a vicious cycle of poverty by impacting economic productivity, particularly in regions with high transmission rates (WHO, 2020). The African countries still bears over 80% of the global malaria burden, and it is estimated that approximately 57 million cases of malaria and nearly 100,000 malaria-related deaths occur each year (WHO 2020). In Rwanda, 1.8 million children less than age 5 and 443,000 pregnant women developed the disease in 2016 (PMI 2017). Of the 30 districts in Rwanda, 19 are prone to epidemics and malaria is endemic in 11 including Gasabo district. RDHS 2014/15 and RDHS 2019/20 reported that the prevalence of malaria in Kigali city were 0% and 0.6% respectively (MoH, 2023). The Rwanda Malaria Control Programme classified Gasabo District as having moderate malaria endemicity, while Nyarugenge and Kicukiro districts were classified as low endemicity zones among the four main malaria epidemiological zones classification done based on the annual parasite incidence (API) per district (PMI 2023). In Gasabo District, there were 122,103 reported malaria cases in 2020, with a rate of 191 cases per 1000 population at risk. The resurgence of malaria cases from 2012 to 2017 was notable among children under five and pregnant women. In Gasabo District, factors like inconsistent ITN use, misconceptions about malaria, and poor medication adherence hinder prevention efforts. Understanding these obstacles is crucial for developing tailored strategies to combat malaria resurgence.

2. Materials and methods

2.1 Research design

In this study, the researcher used a cross-sectional research design and adopted a quantitative research approach.

2.2 Participants

The study targeted adults' people aged between 18-65 years in Gasabo district in Kigali city, Rwanda.

Inclusion Criteria: Residence in Gasabo District, Rwanda; Aged between 18 and 65 years old; Willingness to participate and Ability to provide informed consent.

Exclusion Criteria: Non-residents of Gasabo District; Aged less than 18 years and above 65 years old; Refusal to participate and Inability to provide informed consent. The sample was composed of 400 persons calculated based on the Yamane's formula.

2.3 Research instruments

To collect the data, a written semi-structured questionnaire (English) was used and translated in Kinyarwanda. Four professional nurses, two males, and two females, were recruited for the study data collection and given one day intensive training and then deployed to the selected sector. They were daily supervised by the principal investigator to ensure data quality. The questionnaire included closed questions that focused on the following topics: i) socio-demographic information of the participant and the household head, ii) household assets, iii) knowledge on malaria transmission, signs and symptoms of malaria, and how to prevent malaria, iv) prevention practices, v) attitudes toward malaria and, vi) care seeking practices for malaria. Written consent to participate was given at the beginning of each interview. During the pilot study, the questionnaire tool was tested in the population from Kicukiro sector and Gahanga sector.

2.4 Data analysis procedure

A unique identifier was attributed to each participant for confidentiality. The data collected were taken from the server and checked for the completeness and consistencies. Cleaned data were analyzed using SPSS version 25. Initially, weighted frequencies and percentages of the study sample's baseline characteristics were given using descriptive analysis. Second, to ascertain the

distribution of sociodemographic traits based on the levels (low, medium, and high) of knowledge regarding the causes, symptoms, and prevention of malaria.

A set of five questions regarding the causes, signs, and symptoms of malaria, primary vector, transmission, malaria prevention methods, recommended treatment for uncomplicated malaria, and use of treated bed nets be. Respondents were asked to tick as many things as possible and categorize their level of knowledge as high, moderate, or low. One (1) point was assigned for each correct answer and 0 points for incorrect or unsure answers. The total knowledge score for each respondent was the sum of the points obtained from all five questions, with a maximum possible score of 5. All statistical tests, including the proportions of replies within three categories of knowledge levels, was conducted at a 95% confidence interval to evaluate the participants' knowledge. In addition, chi-square and the odds ratio under the appropriate P-value was used to compute the relationships between those categories. To score and measure the knowledge of participants toward malaria prevention and management, research divided the total points into ranges to create knowledge levels. For instance: High Knowledge: 80-100% of total points, Moderate Knowledge: 50-79% of total points, Low Knowledge: 0-49% of total points.

2.5 Ethical consideration

Concerning ethical considerations, it was done in different steps. 1st, the researcher respected ethical approval procedures. Prior to conducting this study, ethical clearance was given from Mount Kenya University. Permission from Gasabo District to collect data was obtained prior to the beginning of data collection. The respondents were given a consent form to be filled as a sign of voluntarily willing to participate in the study. They were informed that their opinion must be kept in a strict confidentiality. They were assured that there is no risk in participating in the study. They were told that there is no monetary gain in the present research but that they could benefit in interventions made after the research results. They were then informed and assured that the shared data must be stored confidentially.

3. Findings

The majority of respondents, 349 (87.25%), were aware that mosquito bites are a factor in malaria transmission. Additionally, 300 respondents (75.00%) recognized stagnant water as a contributing factor, while 138 (34.50%) identified poor environmental hygiene, such as unclean

houses, nearby bushes, and poor drainage of stagnant water, as factors contributing to the spread of malaria. Participants were categorized based on their knowledge levels regarding the causes of malaria transmission: 57 (14.8%) had a high level of knowledge, 243 (63.3%) had a moderate level, and 84 (21.9%) had a low level. The majority, 367 (91.75%), perceived malaria as a serious problem that can be fatal if not treated promptly. Most respondents, 335 (83.75%) and 313 (78.25%), recognized headache and fever, respectively, as common symptoms, while 287 (71.75%) identified body pain. Additionally, the majority, 218 (54.50%), acknowledged that malaria can be prevented.

Table 1. Respondents' knowledge on Malaria, Gasabo District, Rwanda

Variables	Freq	Percent (%)
Malaria causal/related factors		
Mosquito bites	349	87.25
Presence of stagnant	300	75.00
From forest	239	59.75
Human-to- human	105	26.25
From weather/sun	87	21.75
Unclean house	138	34.50
Use Traditional healers	103	25.75
Eat sugar cane	99	24.75
Malaria as a serious problem		
Very serious problem	137	34.25
Serious problem	119	29.75
Moderate problem	111	27.75
Small problem	21	5.25
Not a problem	12	3.00
Signs/Symptoms of Malaria		
Headache	335	83.75
High temperature/ fever	313	78.25
Chills	251	62.75
Vomiting	304	76.00
Body pains	287	71.75
Loss of energy	302	75.50
Delirium	188	47.00
Dizziness	235	58.75
Loss of appetite	298	74.50
Ever heard governmental action for malaria prevention using LLINs		
Yes	161	40.25

No	143	35.75
Don't know	96	24.00
Can Malaria be prevented		
Yes	218	54.50
No	104	26.00
Uncertain	78	19.50

Half of the respondents (200 out of 400), or 50.00%, displayed a high level of knowledge about malaria. In contrast, approximately one-third of the respondents (130 out of 400), or 32.50%, were categorized as having moderate knowledge. A smaller group (70 out of 400), or 17.50%, showed low knowledge, correctly answering only 0 to 2 questions. This underscores a significant gap in awareness and understanding of malaria, indicating a pressing need for enhanced educational interventions. This group, with limited knowledge, is at higher risk and should be a focus for future public health education initiatives.

Table 2.Overall score of Malaria knowledge amongst respondents in Gasabo District, Rwanda

Knowledge level		Number	Percentage
High	200		50.00
Moderate	130		32.50
Low	70		17.50
Total	400		100.00

Respondents exhibit a wide range of attitudes toward malaria control and prevention, reflecting various perspectives and experiences. Financial constraints are a significant issue, with only 47.75% of respondents agreeing that they have sufficient funds for malaria control equipment, while 28.25% disagree. Time and effort constraints also limit prevention activities, with 45.75% and 53% agreeing that these factors are challenging, though notable minorities, 30.25% and 25.75%, disagree. Concerns about equipment availability are evident, with 46.25% affirming they have the necessary equipment and 32.5% disagreeing. The ability to replace broken gauze screens is split, with 48.75% agreeing and 26% disagreeing. A strong majority, 53.75%, feel capable of addressing water accumulations around their homes.

Regarding attitudes toward consistent malaria prevention, 58.25% of respondents agree that daily checks and restrictions of breeding habitats are important. However, availability of spraying equipment and mosquito nets/repellents in their villages is less assured, with only 40.25% and

43% in agreement, respectively. A significant 44.75% disagree with the notion that combating malaria is futile, indicating general optimism about the effectiveness of prevention measures.

Opinions on Long-Lasting Insecticidal Nets (LLINs) are mixed. While 57.15% view LLINs as similar to window or door nets, only 44.25% agree that LLINs make no difference in malaria control, with a similar proportion, 44%, disagreeing. Negative perceptions of LLINs are prevalent, with many respondents associating them with unpleasant odors (28.75%), skin rashes (27%), heat (29%), sneezing and coughing (28%), and hallucinations (22%). Misconceptions about LLINs' effects on young children and pregnant women are also present, with 20.75% and 21.75% agreeing with these false beliefs. Nonetheless, a substantial majority, 68.25%, disagree that LLINs cannot prevent and kill mosquitoes, and 60.75% disagree that LLINs are not freely available or are expensive.

Table 3. Respondents' Attitudes towards Malaria Prevention and management

	Strongly agree/Agree		Neither agree nor disagree		Disagree/Strongly disagree	
	n	%	n	%	n	%
13. LLIN use is similar as window/door net use	229	57.15	48	12.00	123	30.75
14. LLIN doesn't make any difference in malaria control and prevention	177	44.25	47	11.75	176	44.00
15. LLIN causes bad odors	115	28.75	53	13.25	232	58.00
16. LLIN causes skin rashes	108	27.00	74	18.50	218	54.50
17. LLIN causes heat	116	29.00	58	14.50	226	56.50
18. LLIN causes sneezing and coughing	112	28.00	44	11.00	244	61.00
19. LLIN causes hallucinations and bad dreams	88	22.00	54	13.50	258	64.50
20. The substance in LLIN can kill under five children	83	20.75	57	14.25	260	65.00
21. LLIN can cause nausea during pregnancy	87	21.75	66	16.50	247	61.75
22. LLIN cannot prevent and kill mosquitoes	79	19.75	48	12.00	273	68.25
23. LLIN is not freely available LLIN is expensive	104	26.00	53	13.25	243	60.75
29. I have enough money to spend on equipment to control malaria	191	0.00	96	24.00	113	0.00
30. I have the time to consistently	183	0.00	96	24.00	121	0.00

spray the home.

31. I have the energy to spray the home so often	212	0.00	85	21.25	103	0.00
32. I have the equipment to spray the home.	185	0.00	85	21.25	130	0.00
33. I can replace broken gauze screens for all the openings of my home.	195	0.00	101	25.25	104	0.00
34. I can treat/drain any accumulation of water around the house.	215	0.00	99	24.75	86	0.00
35. Restricting and checking availability of potential breeding habits should be conducted day by day.	233	0.00	90	22.50	77	0.00
36. The equipment to spray homes is always available in my village.	161	0.00	106	26.50	133	0.00
37. Mosquito bed nets and repellent are always available in my village.	172	0.00	111	27.75	117	0.00
38. I feel it is a waste of time to attempt to combat malaria since people get it in any case.	131	0.00	90	22.50	179	0.00
39. Sleeping in mosquito net doesn't give the guarantee of malaria prevention.	105	0.00	95	23.75	200	0.00
40. You are one of the important people in preventing malaria transmission.	217	0.00	96	24.00	87	0.00

The overall attitudes towards malaria control and prevention among respondents are predominantly Positive, with (273) 68.25% of respondents exhibiting positive attitudes and (127) 31.75% showing negative attitudes.

Table 4. Overall score of Malaria Prevention and Management attitudes among respondents.

Level of Attitudes	Number	Percentage
Positive (≥ 13 scores)	273	68.25
Negative (< 13 scores)	127	31.75
Total score	400	100.00

A significant proportion of households (53.75%) reported having a member who contracted malaria, highlighting the disease's prevalence in the district and underscoring the urgent need for effective prevention and treatment strategies. Among those who experienced malaria, 47.75% of

respondents indicated that they sought treatment at the nearest health facility, reflecting a positive trend toward professional medical care. However, 19.75% opted to purchase medication from local shops, which may suggest issues with self-medication practices or challenges in accessing appropriate medical care. Additionally, 13.25% of respondents reported taking no action, and 23.75% took other unspecified measures, indicating potential gaps in both knowledge and access to proper malaria treatment.

Upon recognizing signs and symptoms of malaria, respondents employed various immediate actions. The most common practices included giving treatment (73.75%), applying cold applications or unclothing (72.5%), transferring the patient to a health facility (72%), giving more drinks (61.75%), and using traditional medicines (34.75%). Furthermore, 66.25% of respondents mentioned transferring the patient to a pharmacy. These practices reflect a mix of modern medical approaches and traditional remedies, indicating an intersection of cultural practices and formal healthcare. When it comes to the timing of treatment after suspecting malaria symptoms, 41.5% of respondents administered treatment within 24 hours, which is crucial for effective management and reducing the risk of severe complications. Meanwhile, 24.25% waited for 2-3 days, and 24% for 4-6 days, which might delay recovery and increase the likelihood of complications.

Alarming, 10.25% delayed treatment for seven days or more, suggesting a lack of urgency or awareness about the critical nature of prompt malaria treatment. Awareness of Artemisinin-Combination Therapy (ACT), a recommended treatment for malaria, was relatively low, with only 45.25% of respondents having heard of it. Among those aware of ACT, 26.25% had used it for malaria treatment, while 12% had not, and 7% could not remember. This points to a need for increased education and dissemination of information about effective malaria treatments.

Table 5. Respondents' practices towards Malaria prevention and management in Gasabo

Variable	Percentage(%)	
Freq		
46. Have anyone in your household had malaria?		
Yes	215	53.75
No	185	46.25
46a. If yes, what do you do when you or a member of your household contracted malaria?		
Went to the nearest health facility	191	47.75

Bought drugs from the local shop	79	19.75
Did not do anything	53	13.25
Took other steps	95	23.75
41. What do you do, if you or one of your family member present, some signs and symptoms of malaria.		
Cold application/unclothe	290	72.5
Give treatment	295	73.75
Give more drinks	247	61.75
Transfer (s/h) to Health facility	288	72
Use traditional medicines	139	34.75
Transfer (s/h) to Pharmacy	265	66.25
42. How soon after suspecting those signs and symptoms of malaria, would you give (s/h) treatment?		
One day (within 24hours)	166	41.5
2-3 days	97	24.25
4-6 days	96	24
7 days or more	41	10.25
47. Have you ever heard of artemisinin-combination therapy (ACT)?		
Yes	181	45.25
No	219	54.75
47a. If Yes, have you or any member in your household ever used ACT for malaria treatment?		
Yes	105	26.25
No	48	12
Can not remember	28	7

The majority of respondents (22.75%) spray the outside of their house at least once a week. A significant portion does this very seldom (21.50%), and almost equal proportions never or do it every day. The use of mosquito coils is fairly evenly distributed across different frequencies, with the largest group (21.25%) using them very seldom and the smallest group (18.00%) never using them. Furthermore, a significant portion of respondents (42.00%) never use traditional medicine for malaria prevention. The use is generally low, with only 9.50% using it every day. The most common frequency for Dressing the child with clothes that cover arms and legs practice is every day (31.50%), suggesting that it is a relatively popular method. However, 21.00% of respondents never use this method. Moreover, the application of mosquito repellent on children's skin shows a bimodal distribution, with 25.00% doing it every day and 26.75% never doing it. The largest group sprays the inside of their house very seldom (25.00%), followed by those who never do it (22.50%). Only 16.75% do it every day.

Table 6. Personal protective measures against mosquito bites taken by respondents in Gasabo District, Rwanda

Variable	Number (n=400)	Percentage
Spray the outside of the house		
Every day	78	19.50
At least once a week	91	22.75
1 to 3 times a month	71	17.75
Very seldom	86	21.50
Never	74	18.50
Use mosquito coils		
Every day	77	19.25
At least once a week	82	20.50
1 to 3 times a month	84	21.00
Very seldom	85	21.25
Never	72	18.00
Make use of traditional medicine (Leaves of certain plants)		
Every day	38	9.50
At least once a week	59	14.75
1 to 3 times a month	68	17.00
Very seldom	67	16.75
Never	168	42.00
Dress the child with clothes that covers his/her arms and legs		
Every day	126	31.50
At least once a week	53	13.25
1 to 3 times a month	64	16.00
Very seldom	73	18.25
Never	84	21.00
Apply mosquito repellent on the skin of your child		
Every day	100	25.00
At least once a week	61	15.25
1 to 3 times a month	59	14.75
Very seldom	73	18.25
Never	107	26.75
Spray the inside of the house		
Every day	67	16.75
At least once a week	78	19.50
1 to 3 times a month	65	16.25
Very seldom	100	25.00
Never	90	22.50
Make smoky fires at dusk to keep mosquitoes away		
Every day	58	14.50

At least once a week	69	17.25
1 to 3 times a month	52	13.00
Very seldom	83	20.75
Never	138	34.50

Seven items were used in this study to measure the preventive practices against malaria. Each item was scored, and the sum of all individual scores was then calculated. For example, if a respondent mentioned always sleeping under a bed net, they received two points; if they indicated that they occasionally used good malaria control practices, they received one point. Lastly, individuals who were identified as having never followed effective practices for malaria prevention and control received a score of zero. Regarding malaria control, 54.39% (218) of study participants showed fair practices, 19.43% (78) had good practices, and 26.18% (105) of respondents showed poor malaria preventative practices with regard to malaria eradication.

Table 7. Distribution of respondents "Malaria Preventive Practices"

Practice level	Number	Percentage
Good => 10	78	19.43
Fair = 7-9	218	54.39
Poor <= 6	105	26.18
Total	400	100
Minimum = 0		
Maximum = 14		

Table 11 presents an analysis of the relationship between knowledge levels and overall attitudes, categorizing attitudes into two levels: Negative and Positive. The Chi-square test results and corresponding p-value are provided to assess the statistical significance of the association between knowledge levels and attitudes. The data encompasses a total of 400 observations distributed across different combinations of knowledge levels and attitudes. When examining individuals with low knowledge levels, a significant majority, 70 individuals (55.1%), exhibit negative attitudes. In contrast, only 27 individuals (9.9%) with low knowledge levels display positive attitudes. This indicates a strong tendency for those with low knowledge to have negative attitudes. For individuals with moderate knowledge levels, the distribution becomes more balanced. A considerable portion, 44 individuals (34.6%), with moderate knowledge levels have negative attitudes, while a comparable number, 46 individuals (16.8%), exhibit positive

attitudes. This suggests that moderate knowledge levels are associated with a mix of both negative and positive attitudes, though negative attitudes still dominate.

In stark contrast, individuals with high knowledge levels predominantly exhibit positive attitudes. A substantial majority, 200 individuals (73.3%), with high knowledge levels display positive attitudes, while only 13 individuals (10.3%) with high knowledge levels have negative attitudes. This highlights a strong correlation between high knowledge levels and positive attitudes. The Chi-square value of 13.29 with a p-value of 0.021 indicates a statistically significant association between knowledge levels and attitudes. The p-value ($p = 0.021$) suggests that the observed association is unlikely to be due to random chance, reinforcing the conclusion that knowledge levels significantly influence attitudes.

Table 8. Summary of respondents' knowledge level within tabulated summary of respondents' attitudes

	Overall scores of Attitudes				Chi-square	p-value
	Negative		Positive			
	n	%	n	%		
Knowledge						
Low level	70	55.1	27	9.9	13.29	0.021
Moderate	44	34.6	46	16.8		
High level	13	10.3	200	73.3		
	127	100.0	273	100.0		

The table 12, provides an analysis of the relationship between knowledge levels and the overall score of practices, with the practices categorized into three levels: Poor, Fair, and Good. The Chi-square test results and p-value are included to determine the statistical significance of the association between knowledge levels and the overall score of practices. The data encompasses a total of 400 observations, each classified according to their knowledge level and corresponding practice score. When examining individuals with a low level of knowledge, it is evident that a significant portion, 47 individuals (40.6%), fall into the Poor practices category. This indicates a notable link between having low knowledge and engaging in poor practices. Conversely, only a small percentage, 9 individuals (11.8%), with low knowledge demonstrate Good practices, suggesting that low knowledge is infrequently associated with high-quality practices.

For those with moderate knowledge, the distribution shows a shift towards Fair practices. A significant number, 130 individuals (59.1%), with moderate knowledge are associated with Fair

practices, while 35 individuals (33.9%) are linked to Poor practices. A smaller group, 19 individuals (24.6%), with moderate knowledge achieve Good practices, indicating that moderate knowledge levels lead to better practices than low knowledge, but still not as optimal as high knowledge levels. In stark contrast, individuals with high levels of knowledge predominantly exhibit Good practices. A substantial majority, 49 individuals (63.6%), with high knowledge are linked to Good practices, while only 21 individuals (20.4%) with high knowledge fall into the Poor practices category. This underscores a strong correlation between high knowledge levels and high-quality practices. The Chi-square value of 23.27 with a p-value of less than 0.001 indicates a highly significant statistical association between knowledge levels and the overall score of practices. The very low p-value ($p < 0.001$) suggests that the observed association is not due to random chance, confirming the significant influence of knowledge on practice quality.

Table 9. Summary of respondents' knowledge level within tabulated summary of respondents' practices

Study variable	Overall score of Practices							
	Poor		Fair		Good		Chi-square	p-value
	n	%	n	%	n	%		
Knowledge								
Low level	47	40.6	70	31.8	9	11.8	23.27	<0.001
Moderate	35	33.9	130	59.1	19	24.6		
High level	21	20.4	20	9.1	49	63.6		
Total	103	100.0	220	100.0	77	100.0		

The table 13 presents a cross-tabulation of attitudes and the overall score of practices, categorizing the practices into three levels: Poor, Fair, and Good. The Chi-square test results and corresponding p-value are also included to assess the statistical significance of the association between attitudes and the overall score of practices. The data comprises a total of 400 observations distributed across different combinations of attitudes and practice scores. When examining attitudes categorized as negative, it is evident that a substantial majority, 87 individuals (84.5%), fall within the Poor practices category. This suggests a strong correlation between having a negative attitude and engaging in poor practices. In contrast, only a small fraction, 9 individuals (11.7%), with negative attitudes demonstrate Good practices, indicating that negative attitudes are less likely to be associated with high-quality practices.

On the other hand, for those with positive attitudes, the distribution shifts significantly. A mere 16 individuals (15.5%) with positive attitudes are associated with Poor practices, while a notable

portion, 68 individuals (88.3%), are linked to Good practices. This highlights a pronounced trend where positive attitudes correspond with better practice scores. The Chi-square value of 152.25 with a p-value of less than 0.001 indicates a highly significant statistical association between attitudes and the overall score of practices. The low p-value ($p < 0.001$) implies that the observed association is unlikely to be due to chance, thereby reinforcing the conclusion that attitudes significantly influence the quality of practices.

Table 10. Summary of respondents' attitudes within tabulated summary of respondents' practices

Study variable	Overall score of Practices							Chi-square	p-value
	Poor		Fair		Good				
	n	%	n	%	n	%			
Attitudes									
Negative	87	84.5	127	57.7	9	11.7	152.25	<0.001	
Positive	16	15.5	93	42.3	68	88.3			
Total	103	100.0	220	100.0	77	100.0			

4. Discussion

The findings of this study provide a comprehensive overview of the knowledge, attitudes, and practices (KAP) regarding malaria prevention and management among respondents in Gasabo District, Rwanda. This discussion compares these findings with previous studies conducted within the past decade to contextualize the current state of malaria awareness and control in the region. The study revealed that half of the respondents (50%) demonstrated a high level of knowledge about malaria, with scores ranging from 4 to 5 points. This high level of awareness is encouraging and aligns with findings from a study conducted in Tanzania, where 53% of respondents showed high knowledge about malaria transmission and prevention methods (Mazigo et al., 2020). However, in Gasabo District, 32.5% of respondents had moderate knowledge, and 17.5% exhibited low knowledge, indicating gaps that need addressing. A study in Nigeria similarly found that while a majority had good knowledge of malaria, a significant proportion still had misconceptions about the disease (Afolabi et al., 2019). These findings highlight the ongoing need for targeted educational interventions to improve malaria knowledge further.

The overall attitudes towards malaria control and prevention in this study were predominantly positive, with 68.25% of respondents exhibiting positive attitudes. This result is consistent with a study in Ethiopia, where 70% of participants showed positive attitudes toward malaria prevention (Yaya et al., 2017). Positive attitudes are crucial for the successful implementation of malaria control measures. However, the presence of 31.75% of respondents with negative attitudes underscores the need for continuous community engagement and education to shift these perceptions. In terms of practices, the study found that 53.75% of households reported having had a member who contracted malaria. This high prevalence aligns with findings from a study in Uganda, where 60% of households reported malaria cases (Afolabi et al., 2019). The practice of seeking medical help was encouraging, with 47.75% of respondents going to the nearest health facility. However, the 19.75% who resorted to buying drugs from local shops highlights potential issues with self-medication, a concern also noted in a study from Kenya (Nneka & Okagua, 2019). Additionally, the delayed treatment observed in 34.25% of respondents who waited for more than two days to seek treatment reflects a critical area for improvement, as prompt treatment is vital for malaria management. The use of personal protective measures against mosquito bites varied among respondents. For instance, 22.75% of respondents sprayed the outside of their house at least once a week, and 31.5% dressed children in clothes that covered arms and legs daily. These practices are comparable to findings from a study in Ghana, where 25% of households used insecticide sprays and 35% practiced protective clothing for children (Mazigo et al., 2020). However, the relatively low use of mosquito repellents and traditional medicines indicates areas where further education and resource provision could enhance prevention practices.

Overall, 54.39% of study participants in Gasabo District showed fair malaria preventive practices, 19.43% exhibited good practices, and 26.18% had poor practices. These results are similar to a study in Mozambique, where 56% of respondents reported fair practices, and 22% had good practices (Imboumy-Limoukou, et al., 2020). The findings suggest that while a significant portion of the population engages in malaria preventive measures, there remains a considerable gap that needs addressing through enhanced community-based interventions and health promotion activities.

Moreover, the results indicate significant associations between several demographic factors and malaria prevention practices. Older age groups (>34 years) demonstrate better practices, aligning with findings from Debela (2019) who reported increased malaria awareness with age. Marital status also influences practices, with married individuals showing better practices, consistent with the results of Yaya et al. (2017), who found that marital status positively impacts health behaviors. Education level significantly affects malaria prevention, with higher education correlating with better practices. This supports findings by Mboera et al. (2013) who reported that higher education levels enhance malaria knowledge and preventive actions. Professional qualification and employment status also show significant associations, with public servants and those in specific professions like nursing displaying better practices. This mirrors findings from similar studies, such as that by Afolabi et al. (2019), highlighting the role of occupational exposure and training in influencing health behaviors. However, place of residence and income per day show less significant associations, differing from previous research like Ojonget al. (2023), which suggested that socioeconomic factors heavily impact malaria prevention practices. This discrepancy might be due to regional differences in healthcare access and education.

5. Conclusion

The research findings from Gasabo District provide a comprehensive understanding of the current state of knowledge, attitudes, and practices towards malaria prevention and management among adults. The data reveals a dichotomy: while a significant portion of the population demonstrates high knowledge and positive attitudes towards malaria control, substantial gaps remain that need urgent attention. The attitudes towards malaria prevention and management are predominantly positive, with over two-thirds of respondents exhibiting supportive attitudes. In terms of practices, the research revealed a mixed picture. While nearly half of the respondents seek professional medical help when malaria strikes, the reliance on local shops for medication and the significant proportion of respondents who do nothing in response to malaria symptoms point to critical gaps in healthcare access and knowledge. Overall, the preventive practices against malaria indicate that while fair practices are prevalent, there is a significant portion of the population that still engages in poor preventive behaviors.

7. Recommendations

In order to improve and implement malaria control interventions, established health education programmes should be designed and implemented. Also, to ensure that people can develop a positive attitude in relation to malaria prevention and management for malaria elimination, several public health educations about malaria control strategies are required. For that purpose, the directors of health units at the district and community levels must be guided by a clear malaria management guideline and envoys lines, which must be provided by the ministry of health. The Ministry of Health must issue directives and guidelines for the management of malaria that are explicit enough to serve as a guide for district and community health unit directors.

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