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Bed net use and malaria treatment-seeking behavior in artisanal gold mining and sugarcane growing areas of Western Kenya highlands

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Abstract

Provision of the bed net in Sub-Saharan Africa has substantially resulted in the decrease in malaria incidences in the region. However, malaria still ravages these regions causing significant deaths. This situation has been attributed to socio-economic inequalities that reduce access to the net, failure to seek treatment, and poor antimalarial drug use. Information about these factors in malaria control in Western Kenya highlands is not clearly documented. This study sought to find out bed net availability and use, treatment-seeking, and antimalarial drug use behavior in two rural communities. The study was a qualitative-quantitative baseline cross-sectional survey carried out in two rural villages in Western Kenya highlands in November – December 2018. Focus group discussion, a semi-structured questionnaire, and in-depth interviews were conducted in 736 households to determine: socio-demographic characteristics; bed net availability and use; action taken when sick with malaria, and anti-malarial drug usage. Socio-demographic characteristics and the responses of the participants were expressed as percentages. Dependent and independent variables were cross-tabulated for calculation of OR and association was tested

using Pearson Chi-square at 95% CI and a $p \leq 0.05$ was considered significant. Ninety-three percent of the respondents had used the net the previous night, females (56.50%) constituted the majority of respondents, going to health facility (84.26%) was the preferred action taken when a person had malaria, Artemether Lumefantrine (90.19%), and a pain killer was the most cited drug, 22.96% of the responders reported to have failed to complete anti-malarial dose saying that they had recovered from the malaria bout and 9.80% reported to re-use the remaining part of the dosage. This was the first study in mining and sugarcane growing communities in Western Kenya Highlands that has shown that there was no association between socio-demographic parameters and bed net use, action taken when having malaria, and adherence to drug use. The two rural communities have the bed net and know its use. They have good knowledge of malaria and seek treatment whenever they saw malaria signs. The study also reported that the action the sick person took when they had a malaria bout, the drug they got from the health facility, or failure to complete an AL dosage regimen was not associated with socio-demographic characteristics of the responder. These findings raise the need for further qualitative studies in other settings to accept or deny that there was no association between socio-demographics and action taken when hit with malaria bout, the drug used, and failure to complete drug dosage.

Keywords: Western Kenya Highlands; Bed net; malaria treatment; Anti-malarial drug; Dose completion

1. Introduction

Malaria is a major disease threat to 3.2 billion people around the world causing the deaths of 438,000 people with Africa accounting for up to 88% of these deaths. In Sub-Saharan Africa (SSA) 90% of the deaths are due to malaria and in Kenya malaria causes 3.5 million clinical cases resulting in 10,700 deaths each year with those living in western Kenya being at the greater risk CDC, (2019). Poor utilization of malaria prevention interventions is cited as a major driver that causes these numbers to surge (Kabaghe *et al.*, 2018). Elimination of the vector through larval source management (LSM), indoor residual spraying (IRS), and using biological means has not yielded 100% results (Russell *et al.*, 2013). Provision of the bed net and its proper use to limit vector-human interaction has yielded a significant reduction in the number of casualties but has not eliminated transmission (Steinhardt *et al.*, 2017), (Ashley *et al.*, 2018). Progress in eliminating malaria in SSA and Kenya is faced with numerous challenges including reduced

funding and lowered prioritization of malaria control activities (CDC, 2019). To fully feel the impact, malaria control tools should be deployed to populations that are at the highest risk of infection (Bashir *et al.*, 2019). The effort has been towards this but malaria resurgence in the highlands in western Kenya (Zhou *et al.*, 2015), is a focal point. This study sought to find out risk factors that may be contributing to this resurgence of the malaria scourge (Cook *et al.*, 2019). This will enable assessment of the vulnerabilities in the population and eventually guide where to target the prevention interventions more. The information obtained will add to the pool of knowledge enshrined in the government of Kenya (GoK) Big Four agenda and Africa Union's (AU) Agenda 2063 that envisages the health, wellness of the people, and access to quality health care as major drivers of socio-economic development.

Previous studies have reported that several factors play a significant role in the maintenance of malaria transmission in the hotspot areas of western Kenya highlands, whose result was the observed increased malaria cases within the region (Cook *et al.*, 2019), (CDC, 2019). Land use types for economic purposes modify the landscape making aquatic breeding habitats to be available throughout the year. The permanency of these habitats affects their productivity and thus the availability of the *Anopheles* mosquito all year round. Land cover changes were critical drivers for temperature rise in the micro-habitats for the mosquito larval stages which subsequently increases the abundance of the malaria vectors. It was imperative to carry out a study to find out the control measures the communities utilized to fight off the possibility of the transmission of malaria in the population (Nicholas *et al.*, 2021), (Kweka *et al.*, 2016). The findings will add value to the malaria control surveillance process.

The adoption of malaria transmission mitigation strategies around the world significantly depends on socio-economic factors of the population. SSA suffers the greatest malaria burden because of low incomes occasioned by a poor socio-economic environment. This socio-economic disparity is majorly felt in children and women who suffer greater malaria bouts. Differential socio-economic proxies play a key role in the perception that malaria is a disease of the poor (Yadav *et al.*, 2014). Poverty is not limited to the people, but also the inability of the government to provide affordable primary health care, train its personnel and do proper promotional campaigns. Additionally, the health facilities should have requisite disease testing kits and adequate drugs (Ajayi *et al.*, 2013), (Yadav *et al.*, 2014). Therefore, more information is

needed to embrace or dispel this notion that socio-economic conditions of communities play a crucial role in the acceptance of malaria transmission mitigation strategies.

Mass anti-malarial drug administration (MDA) has been advocated by international agencies to vulnerable populations. This significantly reduces malaria cases and hence the risk of malaria transmission. MDA has been restricted to endemic zones or islands and in Kenya the Lake Victoria islands and the coastal strip (Gitaka *et al.*, 2017). Governments around the globe formulate policies to govern anti-malarial drug availability and use to the people. In Kenya, the National Malaria Control Programme adopted Artemether-Lumefantrine (AL) as the first-line drug for uncomplicated malaria. Adoption of drug policies around the world is faced with policy, financial and legislative challenges that consequently affect the availability of the drug to the masses that need them (Kangwana *et al.*, 2009). Information, education, and communication (IEC) form the core of the activities that are needed to pass drug and non-drug issues to the recipients. There must not be any ambiguity in drug messages regarding branding, costing, availability, dosage, and side effects. The development of resistance of the malaria parasite to recommended drugs will jeopardize the purpose of malaria prevention (Suresh & Haldar, 2018). Drug compliance by people who antimalarials have been prescribed has been cited as a crucial part of the fight against malaria. Non-compliance has been attributed to failure to complete the dose due to adverse effects or save for future use (Shuford *et al.*, 2016). The economic status of the family impacts the acquisition of the drugs from commercial drug stores in case the health facilities have run out of stock and how fast ill members seek treatment (Chuma *et al.*, 2010). This study envisaged to find out adherence to drug use by two rural communities as a measure to prevent malaria transmission.

2. Methods

2.1 Study sites

The survey was carried out in 2 purposively chosen villages in Kakamega County in Western Kenya highlands which had been reported to have significant aquatic habitats for *Anopheles* mosquito, the principal vector for malaria in the region, and abundant *Anopheles gambiae* s.l in the laboratory-reared mosquitoes (Nicholas *et al.*, 2021). This made the study sites potential areas for malaria transmission. The survey was part of a wider pilot study in western Kenya

highlands regions that have undergone massive environmental modifications to determine their role in the observed increased malaria cases. Rosterman mine in Lurambi Sub-county (Latitude 0.28°N, Longitude 34.75°E) is at an altitude of 1400 - 1500 meters above sea level is dominated by the Isukha sub-tribe of the larger Luhya community. It is an old mine that was vacated by the British Company Rosterman Incorporated in 1952. However, locals still scavenge gold dust from the old mine (Kyalo *et al.*, 2015). Besides gold mining, other economic activities such as peasantry agriculture where they grow a variety of food crops and rear animals, sand harvesting, small scale trade and motorcycle (boda-boda), and 3-wheeler taxi (tuk-tuk) are practiced. Rosterman does not have any public or private health center, and so the residents seek treatment from neighboring health centers at Elwesero, the Administration police line, and GK Prisons in Kakamega town. St Paul Imusonga is the only nearby private health facility. Eluche village in Mumias East Sub-county (Latitude 0.33°N, Longitude 34.48°E) at an altitude of 1300 - 1400 meters above sea level lies in sugarcane belt of Mumias is dominated by the Wanga sub-tribe. Just like Rosterman, residents practice mixed farming following the collapse of sugarcane farming, small-scale trade, and taxi business. Residents of Eluche are served mainly by the Eluche dispensary and are referred to Shianda health center. However, they can also get services from Lusheya and Shianda health centers and private health service providers in Mwitoti and Shianda. In both sites, the populace accesses caregiving centers, by use of boda-boda whom they consider cheaper and convenient or hire tuk-tuk, private vehicles or call for ambulance services from the County referral hospital at Kakamega. Western Kenya highlands have a high malaria prevalence rate.

2.2 Study design

Focus group discussions (FGDs), in-depth interviews (IIs), and questionnaires were used. FGDs were purposely selected to include 3 – 7 recruits from community leaders, administrators and, community health volunteers (CHVs), and a guide. A total of 63 (37 female and 26 male) participants were involved aged 18 years and more. FGDs met for three sessions during the survey period and each session lasted for up to one hour. After designing the questionnaire, it was pre-tested, translated to the local dialect, and the interviewers trained on approaching the participants, questioning, and recording feedback. In a case where the participant was unable to comprehend English or local dialect, the interviewer orally translated the questionnaire to

Kiswahili. Filling the questionnaires was done systematically from household to household. A household was taken to be a house where people slept. The head of the household was the person interviewed or given authority to answer the questions. Other members of the household were allowed to listen to the interview and offer minimal participation. In the case of a polygamous household, wives were preferred as household heads because they were in direct control of their houses. Absence during the survey period and unwillingness to participate in filling the questionnaire, IIs, and absconding from FGDs excluded the person from the study.

2.3 Data collection

During the FGDs data on bed net availability and use, availability of drugs in health facilities, and compliance to drug administration was collected. The questionnaire and IIs collected data on the socio-demographics of participants, action participants took when they had malaria, drugs used when they had malaria, completion of antimalarial dose, and use of the remainder dose of the medicines.

2.4 Limitations of the study

The researchers had no control over the participants selected by the community contact person and therefore there may have been a selection bias. The participants in the FGDs were non-random and the study findings cannot be generalized to the two study sites.

2.5 Data management and analysis

Collected data were entered in MS Excel spreadsheet, checked, and cleaned of errors. It was coded and processed using a statistical package for social sciences (SPSS) version 20. Analyses of the variables were done excluding missing data points which led to variations in the total number of respondents between questions. Socio-demographic characteristics and the responses of the participants were expressed as percentages. The dependent variables: the action taken when having malaria, the antimalarial drug used, failure to complete a malaria dose regimen, and the use of the remaining dose and selected socio-demographic factors (independent variables) were cross-tabulated for calculation of Odds ratios at 95% confidence interval. Association between the variables was tested using Pearson Chi-square with $p \leq 0.05$ considered significant.

3. Results

3.1 *Socio-demographic characteristics of the participants*

The socio-demographic characteristics were as shown in table 1 in which females constituted the majority (56.5%), 20 – 39 years was the modal age (47.1%), 70.1% were married and living together as husband and wife, a majority had attained at least primary education with 14.9% reporting having no education, 32.5% were employed while 9.9% unemployed, basic monthly income had a modal range of Kenya shillings 2,000 – 5,000.

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Variable		Sample size (N)	Percentage (%)
Gender	Female	416	56.5
	Male	320	43.5
Age (years)	≤ 19	80	10.9
	20 – 39	347	47.1
	40 – 59	190	25.8
	≥ 60	119	15.1
Marital status	Married	517	70.1
	Unmarried	123	16.7
	Widow/widower	87	11.8
	Divorced	9	1.2
Level of education completed	No education	110	14.9
	Primary	327	44.4
	Secondary	226	30.7
	Tertiary	62	8.4
	Others	11	1.5
Main occupation	Self-employed in agriculture	163	22.1
	Small scale business	142	19.3
	Employed	239	32.5
	Housewife	119	16.2
	Unemployed	73	9.9
Average monthly income (Ksh)	≤ 2,000	375	51.0
	2,000 – 5,000	249	33.8
	5,000 – 10,000	47	6.4
	≥ 10,000	65	8.8

Table 1: Sociodemographic characteristics of the respondents

3.2 *Bed nets ownership*

Ninety-seven percent (97%) of the sampled households had at least one long-lasting insecticidal treated net (LLIN). The net was either bought, given by government health agencies, or given at

health centers (during neonatal or postnatal care). All the family members used the net while indoors to prevent being bitten by the mosquitoes when they slept. This was corroborated in the FGDs in which it was reported by CHVs that the LLIN was the most widely available net in the households. However, challenges to effective use of the net were also observed.

“Each household has at least a net to protect them from malaria. However, we cannot conclusively tell if it is used always because malaria is still with us,” said a church elder from Eluche.

“Bed net use has been limited by large families or absence of a bed. Children who sleep on the floor may not use the net. This hinders its purpose,” observed a nurse at Rosterman.

When asked if they used the bed net the previous night, 93.17% reported having used it while the rest did not. When asked why they did not use the net, they reported that they were out on duty. This information was corroborated in the FGDs where it was reported some community members do work at night.

3.3 Action taken when having malaria

When asked about the action taken when a member of the household fell sick with malaria, the responses were as shown in figure 1, where going to the health facility was the most preferred action followed by self-treatment. Seeking a traditional healer or herbalist or no treatment at all received zero positive response.

“Adults would self-treat first. They would only seek help from a health center when the symptoms of malaria became more pronounced. Pre-school age children (PSAC) would be taken to health center immediately a first symptom is observed unlike school-going children,” reported a CHV in Eluche FGD.

“Some of us we have to wait for our husbands to return from work to buy us medicine or take us to the dispensary whenever we fall sick,” observed Mama Angie in the Rosterman PAG group.

“There is the challenge of inadequate drugs in the government health facilities. We are forced to buy them from drug stores in the Shianda market. Here the drugs are sold expensively,” said a pastor in Eluche FGD.

It was noted in all the FGDs that the residents knew the signs that compelled them to seek treatment. The notable symptoms mentioned included fever, body ache, joint pains, and headache. However, the onset of these symptoms prompted some to seek medication immediately but others would wait for a day or two before going for treatment. In Rosterman FGD seeking medication from a recognized health facility was highly mentioned:

“Going to a health center when you feel sick enables us to get good assistance because of the tests done. Although it takes longer to get the results, it was worth waiting,” observed a caregiver in Rosterman FGD.

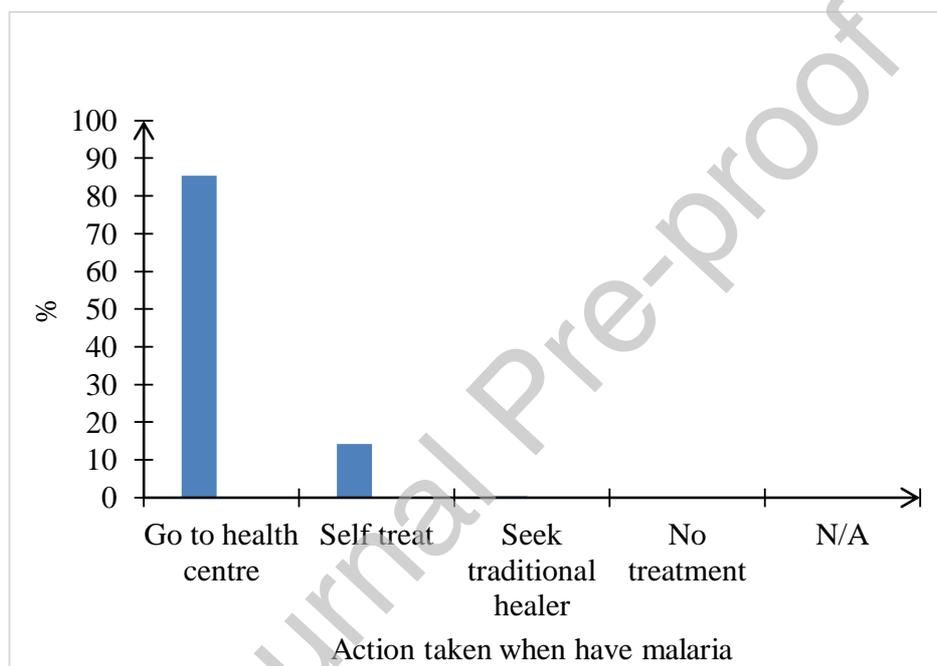


Figure 1: Action taken when having malaria

Percentage (%) on the vertical axis represents the number of respondents reporting the preferred action they took (horizontal axis) whenever a household member had a malaria bout

3.4 Drug used

AL was the main drug that patients were given at health facilities upon being diagnosed with malaria or bought from drug stores if the drug had run out of stock at the health centers. AL and Panadol/Paracetamol were the most preferred combination (90.19%) followed by AL and Brufen (Ibuprofen) (6.81%) as indicated in figure 2. It was reported in all FGDs that AL was the most

available antimalarial drug and that the most dispensed drug combination was AL and a pain killer.

“Panadol/Paracetamol was the most dispensed pain killer along with AL. Ibuprofen was another drug. But a case where chest pain was reported, Amoxylline was also prescribed,” a pharmacist in Rosterman school FGD reported.

“Some of these drugs confuse us. If I have a fever I take paracetamol. If the fever does not go, I then seek help,” said the village elder in Eluche.

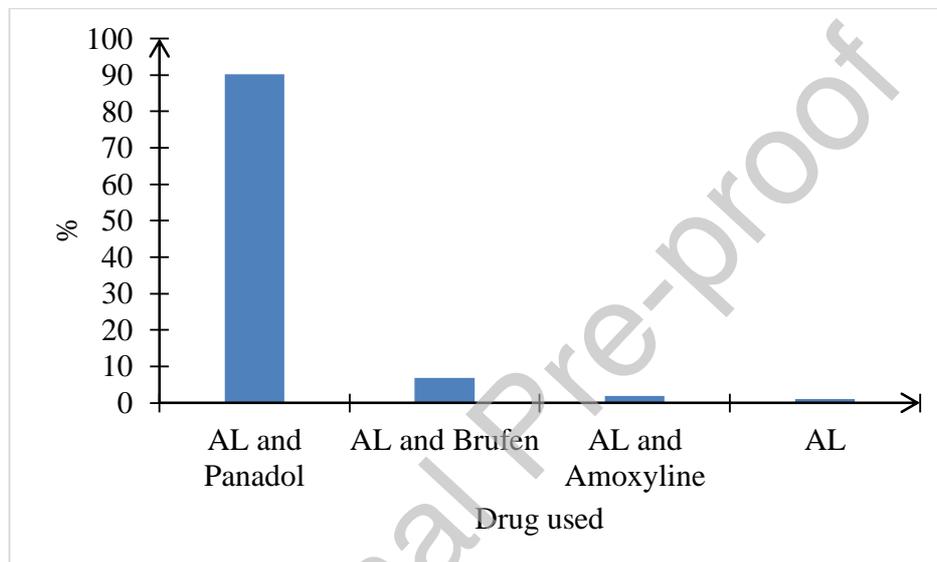


Figure 2: Drug used when one had malaria

Percentage (%) on the vertical axis represents the drug used by the respondents (horizontal axis) whenever a household member had a malaria bout

3.5 Failure to complete anti-malarial dose and the reasons

A good portion (22.96%) of the respondents reported having failed to complete the prescribed AL dosage giving a range of reasons as indicated in figure 3. Having recovered from a malaria bout (79.14%) was identified by most participants as the main reason for failure to complete the dose.

“Most adults supervise their children take the medicines. But many of us fear taking the full dose at the prescribed times and in full dose,” opined the area administrator, Rosterman. “People are given AL or buy them when sick but will hardly complete the dose,” she added.

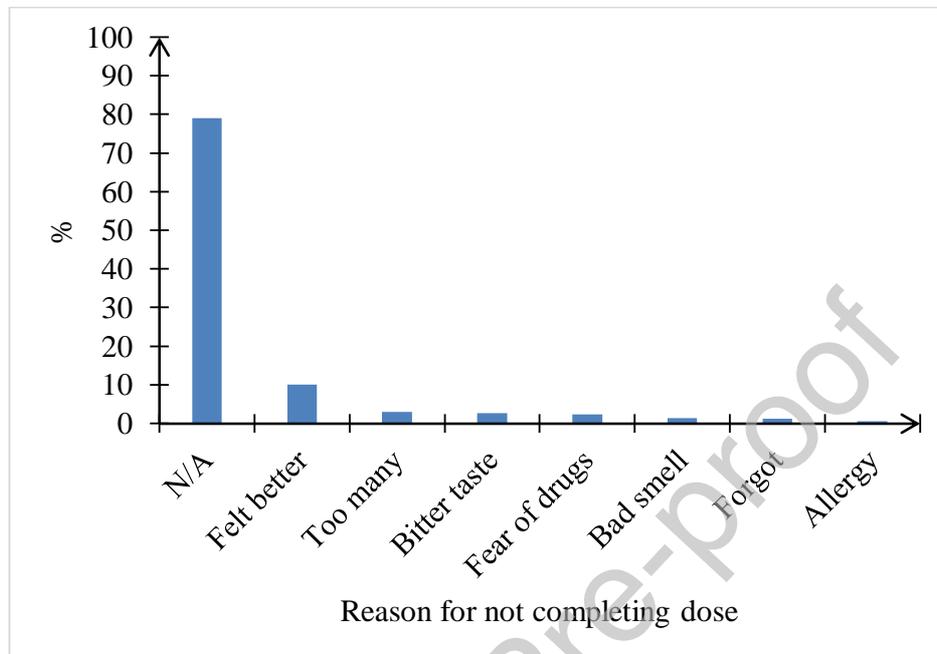


Figure 3: Reason for not completing the dose

Percentage (%) on the vertical axis represents the number of respondents reporting reasons for not completing an antimalarial dose (horizontal axis) whenever a household member had a malaria bout

3.6 Use of remaining part of the dose

Figure 4 shows the reported uses of the remaining part of the dose. With re-used (9.80%) and threw away (8.84%) being the most stated. In the FGDs, participants described the following:

“Most of us women when our sick children are healed, we stop administering the drugs. We keep the remaining until another member of the family fell ill to re-use them. It does not matter if it was the same child or any other member,” stated a female participant in Eluche.

“Some of us are very careless in our houses. We often lose the drugs we are given or buy, especially us miners,” quipped an elderly miner in Rosterman.

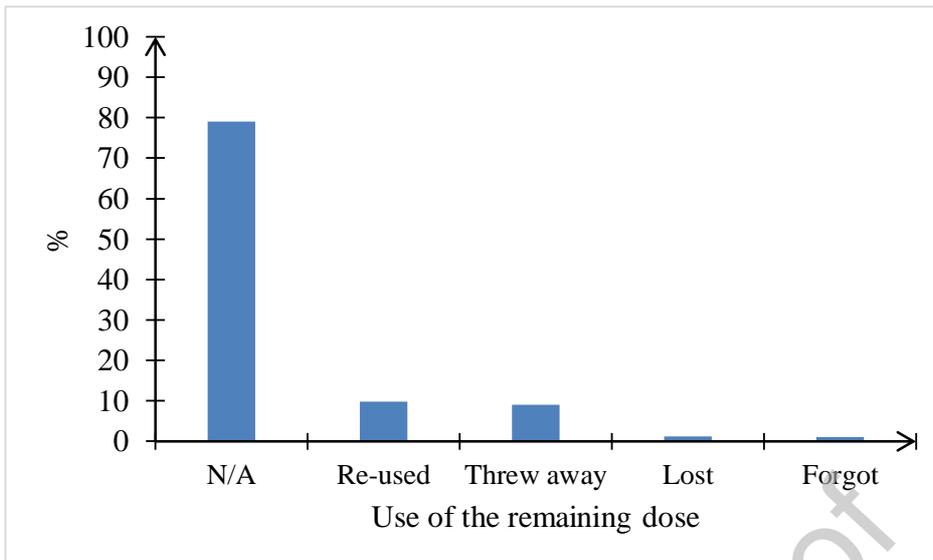


Figure 4: Use of the remaining dose

Percentage (%) on the vertical axis represents reported use of the remainder of the antimalarial dose (horizontal axis) by the respondents

When selected socio-demographic factors were related to knowledge of malaria and anti-malarial drug use as indicated in table 2, there was no association at 95% CI, $p \leq 0.05$. Gender nor level of education did not have a significant association with the action taken by a household that had contracted malaria. Similarly, gender nor occupation did not have a significant association with the failure of a household member to complete a dose of AL. use the remaining antimalarial dose did not depend on the level of education or gender.

Variable	N	Odds Ratio	95 % CI		p-value
			Lower	Upper	
Action taken when having malaria					
Gender					
Female	416	1.195	0.791	1.805	0.397
Male	320	1.026	0.966	1.090	0.459
Level of education					
Educated	626	0.908	0.512	1.609	0.887
Not educated	110	0.987	0.913	1.067	0.741
Failure to complete dose					
Gender					
Female	98	0.929	0.656	1.315	0.678
Male	71	0.983	0.908	1.064	0.724
Occupation					
Employed	25	0.855	0.392	1.863	0.693
Not employed	144	0.984	0.903	1.072	0.409
Use of remaining dose					
Level of education					
Educated	65	0.530	0.237	1.186	0.112
Not educated	112	0.950	0.902	1.002	0.131
Occupation					
Employed	64	0.855	0.392	1.863	0.693
Unemployed	105	0.984	0.903	1.072	0.676

Table 2: Demographic variables and their impact on knowledge of malaria and drug use

4. Discussion

This study showed that the LLIN is the most available bed net that protected people in the two sites from a mosquito bite and hence transmission of malaria. Its availability was due to the roll-back malaria initiative that mainly targets pregnant women and children under five years. This finding was similar to the result of net coverage in SSA by (Singh et al., 2013). The bed net plays a significant role in reducing transmission. However, challenges to its use abound. In this study, it is reported that the larger and the poorer the family was, the more challenges it faced in using the net on day to day basis. And therefore the bed net should be availed to families in proportion to the family size and socioeconomic status. This corroborates findings in Nigeria (Auta, 2012) in which socio-demographics influenced bed net availability and use. People who work at night were unable to use the net and this put them at the risk of being bitten by the mosquito. This was true also for results in Ethiopia (Graves et al., 2011) and Zimbabwe (Maseko & Nunu, 2020) in which people working outdoors at night were unlikely to use a net.

The findings of this study showed that seeking medical assistance was an indicator of good prior knowledge of the symptoms and signs and the debilitating effects of malaria by people in rural settings. Seeking treatment in a health care facility enabled the patient to get a proper diagnosis and hence be given the recommended anti-malarial drugs. These findings implied that seeking prompt treatment by a member of a household was a preventive measure and proper utilization of the available health facilities. This corroborates findings in Bangladesh (Bashar et al., 2012) in which knowledge of malaria symptoms was key to seeking medication. This study showed that the treatment of those who were sick from malaria was not dependent on social or economic status but rather on the ability to relate the signs and symptoms to the disease. This contradicts the study by (Sonkong *et al.*, 2015) along the Thailand-Myanmar border. Self-medication was reported by a section of the responders indicating that they knew about malaria or its symptoms. Other studies have also reported self-treatment as a common practice around the world (Ngatu *et al.*, 2019), (Chipwaza *et al.*, 2014). Going to a health facility by respondents ensured the proper diagnosis and treatment of the disease which was a key factor in the prevention of future infection since it reduced the number of parasite sources that were available to the mosquito. This is supported by studies by (Uzochukwu et al., 2018) in Nigeria in which going to a health center ensured the sick were given a proper diagnosis. This study also reported that there were

differences in time taken between falling ill with malaria and seeking medication between adults and children. The adults would wait for one or two days after the onset to seek medication while PSAC was immediately the symptoms are detected. The promptness of seeking treatment has been reported as a key factor in reducing transmission (Landier et al., 2016). This observation is similar to a study in Nigeria (Uzochukwu et al., 2018). The populace should be instructed on the need to seek early treatment from recognized caregiving facilities and desist from self-medication.

AL was the main antimalarial drug that was prescribed at the health facilities or bought from the drug stores together with a pain reliever drug as was according to the Kenya government ministry of health directive. This finding supports other studies done in Zambia and Nigeria in which proper antimalarial drug supply and management form the main aspects of malaria treatment (Zurovac *et al.*, 2007). The findings support universal access to drugs promptly as a health facility priority and the use of artemisinin-based combination therapies for the treatment of uncomplicated malaria around the world (Winskill *et al.*, 2019). The results are contrary to those done in Nigeria and Kenya in which other drugs are still in use and effective (Uzochukwu et al., 2018). Monitoring and supervision of the prescribed drug regimens use is crucial in hotspot areas. The findings have indicated that a majority of rural communities monitor drug use within their households. However, this adherence was not without its fair share of pitfalls. This was similar to findings by Leslie *et al.* (Leslie et al., 2004) in which drug compliance can be up-scaled by simple messages of encouragement even to the uneducated.

This study reported that a portion of the population failed to complete AL that was prescribed to them for which they cited different reasons. Studies elsewhere have also shown that a section of the study participants failed to complete the AL dosage regimen in which various reasons were also cited. Drug non-adherence has major ramifications on the malaria control strategies as shown by results in Brazil. It has been reported as a precursor to the development of drug resistance in the *Plasmodium* which consequently has an aftereffect on AL efficacy (Souza *et al.*, 2016), (Ferreira & Castro, 2016). This study found no association between socio-demographics and non-adherence to drug regimens. This contradicts the findings of (Simba *et al.*, 2012) which found that privileged families had a higher likelihood of adhering to therapy than poor families. This group of non-adherent responders although insignificant can have a far-reaching impact on

relapse and the magnitude of infections in the population within these rural areas. However, this should be done in different settings to support or dispel this.

Various reasons were given by responders as to why they failed to complete the AL dose regimen. The main ones were that the sick had felt better, stored the remainder of the drugs for use in the future, forgot about them and that the drug had adverse effects on the users. Other researchers elsewhere have reported mild adverse effects, phobia for medication, discouragement by others, and having forgotten as causes of the discontinuation of antimalarial use (Sambili *et al.*, 2016), (Pereira *et al.*, 2011). Sharing drugs with members of the family or neighbors and lack of food to take the medication with have also been documented as other reasons for failure to complete a dosage (Cohen *et al.*, 2010), (Gerstl *et al.*, 2010). Failure to complete a malarial dose has the potential to confound malaria control efforts.

This study has demonstrated that socio-demographic factors do not have an association with decisions taken when participants have contracted malaria concerning treatment-seeking, drug usage, and failure to complete any particular dose. This is supported by another study elsewhere in which non-adherence was not associated with the socio-economic conditions of the participants (Ogolla *et al.*, 2013). However, this contradicts research done elsewhere in which it was reported that demographic and socio-economic factors contributed significantly to drug use patterns as a means of malaria prevention (Simba *et al.*, 2012), (Bruxvoort *et al.*, 2015).

5. Conclusion and recommendation

The findings of this study have illustrated that the bed net is available and used by the majority of rural communities in Western Kenya highlands. The participants had good knowledge of malaria symptoms that would compel them to seek treatment. And that the action the sick person took when they had malaria bout, the drug they got from the health facility, or failure to complete AL dosage regimen was not associated with socio-demographic characteristics of the responder. The populace should be educated on the need for seeking early treatment from a registered health facility. Failure to complete dosage can be improved through enhanced community education and directly observed medication by community health volunteers. These findings raise the need for further qualitative studies in other settings to accept or deny that action taken when hit with malaria bout, the drug used, and failure to complete drug dosage were

not associated with socio-demographics of the populace. The findings would go a long way to enable the success of the GoK Big Four Agenda and AU's Agenda 2063.

6. Declarations

6.1 Ethical consideration

Ethical approval to do the research was granted by Masinde Muliro University of Science and Technology Institutional Ethical Review Committee (IERC) vide approval number MMUST/IERC/090/19. County and national administrative authorities were asked for permission to carry out the study. Written and verbal consent to participate was sought from the head of the household after the interviewer explained the significance of the process and that there was no direct financial benefit.

6.2 Availability of data and material

Data and supplementary material are available from the corresponding author upon request.

6.3 Competing interests

The authors declare that they have no competing interests.

6.4 Funding

The research was self-funded.

6.5 Author contributions

KDM, conceptualized the study as partial fulfillment of the requirements of the award of Ph.D., NLK, PAO, JKC, and DHM assisted in refining the concept and supervising the fieldwork, KDM was the field guide in the FGDs, KDM, and NST carried out data management and analysis, KDM prepared the manuscript and all authors assisted in editing the article and gave authority for it to be sent for consideration for publication.

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Declaration of Competing Interests

The authors wish to confirm that there are no known conflicts of interest associated with this manuscript and that there has no financial support for this work that could have influenced its outcome.

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Declaration of Competing Interests

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