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Factors Associated with Malaria Test Preference among Households in Rubavu District, Rwanda: A Cross-sectional Study

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Abstract

Background: If people are not diagnosed and treated promptly for malaria, they may develop severe complications and death. Globally, an estimated 3.3 billion people are at risk of being infected with malaria and 1.2 billion are at high risk. The World Health Organization recommends using malaria rapid diagnostic tests (RDTs) or microscopy followed by prescribing antimalarial only to patients who have a positive test result. In Rwanda, malaria RDT was introduced in 2008 to be used by community health workers (CHWs) before offering treatment. This study assessed malaria test preference and associated factors among community members in Rubavu district, Rwanda.

Methods: This was a quantitative cross-sectional study. A structured self-administered questionnaire was given to 384 community members in households that were randomly pre-selected from community of Rubavu district. Chi-square test ($p<0.05$) was computed to establish factors associated with preference of malaria diagnostic test.

Results: The result shows that majority (77.6%) of the respondents prefer RDT over microscopy test (22.4%). The RDT was more preferable among household heads with low level of education (never attended, primary school, and secondary school) (p=0.001), with low monthly income (p=0.002) and those with community based health insurance (p=001). Descriptive analysis was also done for perceived benefits of using RDTs, reasons for not accepting RDTs and suggestions to improve RDTs in the community, the results show that majority 96.9% perceived that RDTs is used as fast diagnosis, 84.9% not accept using RDTs because on non-trusted results and 90.6% suggested provision of pictorial job aid to the CHWs.

Conclusion: Universal RDTs to all human species called combination or 'combo' test are the preferred method for the diagnosis of malaria by communities in Rubavu district. The test is more acceptable in households with low level of education, low monthly income, with community based health insurance.

Keywords: Community health workers; Household members; Malaria test; Rapid diagnostic test

Introduction

Malaria is a mosquito-borne disease caused by several plasmodium species such as *P. falciparum*, *P. malariae*, *P. ovale* and *P. vivax* [1]. People with malaria often experience fever, chills, and flu-like illness. If left untreated, it may develop severe complications and death. It is spread by the bite of a female Anopheles mosquito. Transfusion of blood from infected persons and use of contaminated needles and syringes are other potential modes of transmission [1].

Globally, an estimated 3.3 billion people are at risk of being infected with plasmodium and develop malaria, and 1.2 billion are at high risk (>1 in 1000 chance of getting malaria in a year) [2]. New malaria cases fell by 21% between 2010 and 2015 worldwide. Malaria death rates fell by 29% in the same 5-year period. In sub-Saharan Africa, where the disease remains heavily concentrated, malaria case incidence and death rates fell by 21% and 31%, respectively, over this 5-year period [3].

The burden is high in the WHO African Region, where an estimated 90% of all malaria deaths occur, and in children aged less than 5 years, who account for 78% of all deaths [2]. Prompt and accurate diagnosis of malaria is fundamental to effective disease management and essential to improving the overall management of febrile illnesses. WHO currently recommends prompt parasitological confirmation by microscopy or RDTs in all patients suspected of malaria before treatment.

The ongoing implementation of this recommendation is leading to a progressive shift from presumptive treatment towards parasitological confirmation prior to treatment [4]. Moreover, WHO recommends using malaria rapid diagnostic tests (RDTs) and prescribing antimalarials only to patients who have a positive test result [4]. The scaling up of malaria RDTs at all levels of health care is essential to ensure early case detection and appropriate management of malaria [5].

Studies from sub-Saharan Africa document community stigma about drawing blood that may impede acceptability to RDTs. In addition, there is inadequate evidence to support abandoning presumptive treatment and that African health systems have yet to demonstrate the capacity to support a shift toward laboratory-

confirmed diagnosis rather than presumptive treatment of malaria in children under five [6]. Some of these concerns include the implications of not providing treatment to children with false-negative test results. Finally, diffusion of innovations in the health system depends on individuals' perceptions of the innovation, characteristics of the individual who may adopt the change, and contextual factors within the community [7].

It is still unclear what role RDTs will play in a situation where health belief model form recommendations are blended with local and biomedical knowledge, and little is known about whether the community will accept the use of RDTs in the hands of community health workers with low education level and no formal health care background [8]. Therefore, in the interest of bridging this gap of information, this study assessed community acceptability RDTs for malaria diagnosis in Rubavu district, Rwanda. The only district reported the high-burden sector in Rwanda by January 2016.

Methods

Study design and population

This study was carried out in five sectors (Rubavu, Cyanzarwe, Gisenyi, Nyakiliba, and Rugerero sectors) of Rubavu District, Rwanda. A cross-sectional study was employed where a structured questionnaire was administered to head of households or household members over 18 years.

Sample size calculation

Sample size calculation was done using the Kish Leslie (1965) formula:

$n=Z^2pq/d^2$

Where n is the sample size, Z is the z value (1.96 for 95% confidence level), p is the estimated proportion of respondents, q is 1-p, and d is the precision (permitted error or margin error). Since no similar study has been done in the region, estimated proportion (p) of 0.5 was used to estimate sample size so as to give maximum variability.

$Z=1.96\ n=(1.96)^2 \times 0.5 \times(1-0.5)$

$p=0.5\ (0.05)^2$

$q=(1-0.5)\ n=384$

d=5% (0.05 for 95% confidence level)

The total sample size was 384 households.

Sampling technique

Multistage sampling method was used. In the first step Rubavu sector was selected purposively because malaria was reported as the first high burden by January 2016 in Rwanda and then four sectors neighboring to it were selected. In the second stage, 4 villages from each sector were selected randomly using Statistical Packages of Social Sciences software (SPSS) after the list of villages entered into the software in order to generate a list of random numbers. In the third stage, households were also selected randomly using SPSS version 20.

The code and list of households were obtained from the sector administration. Households were distributed according to proportionate to the number of households in each sector.

Data collection methods

Structured questionnaire was administered to 384 head of households selected from the whole population of Rubavu district. The questionnaire was tested if is valid for the field test when were checked for completeness; data entry performed and analyzed to find out if the research objectives was achieved while reliability was also tested when the questionnaire was pre-tested and test-retested in another endemic sector of Rutsiro district during pilot study and then Cochrane's coefficient was calculated to measure the percentage agreement between the responses from the two tests and found a coefficient of 0.9 which considered adequate for field testing of the tool.

The independent variables included socio-demographic characteristics, socio-economic characteristics and also about perceived benefits of using RDTs and reasons for not accepting RDTs.

Data entry and analysis

Quantitative data from the questionnaire were entered into EpiData and transported to SPSS version 20. Descriptive statistics (frequencies and proportion) were used to tabulate and describe the data and inferential statistics (Chi-square) was used to identify factors associated with preference of malaria diagnostic test. P value was set at 0.05 or below.

Ethical approval

Ethical clearance was obtained from ethical committee of Rubavu District Hospital. Approval to conduct the study was sought from Mount Kenya University Rwanda (MKUR); permission from Administration of Rubavu district was sought. The respondents were informed about the study purposes and procedures while oral consent was used for those who never attend school (56 participants).

Each respondent of the study voluntarily signed an informed consent form before participating study subjects were assured of confidentiality and codes were used to replace respondents names during data collection, analysis, presentation and storage.

Results

Score assessment of knowledge level on Malaria symptoms

The score assessment was done for the questions asked about knowledge. Score '1' was given for the correct response and score '0' was given for the incorrect response. The maximum attainable total score was 10 and the minimum score was 1. A percentage score was generated and classified as low knowledge (<50%), moderate knowledge (50-70%) and high knowledge (>70%). Majority of study participants 234 (60.9%) had high knowledge, followed by 93 (24.2%) with low knowledge on malaria symptoms as shown in (Figure 1).

Socio-demographic and socio-economic characteristics stratified by malaria test preference

The highest percentage 116 (30.21%) of respondents were aged between 38-42 years. There was almost equal distribution of gender where about half 196 (51.0%) of respondents were females. In terms of marital status majority of respondents were married 284 (74.0%).

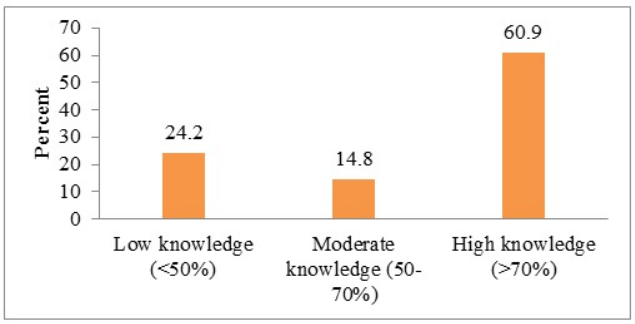

Figure 1: Score assessment of knowledge level on Malaria symptoms. Level of knowledge on malaria symptoms.

Of the total, about three quarters 298 (77.6%) of the respondents preferred RDT for malaria testing. However, these variables were not statistically significantly associated with malaria test preference.

Regarding level of education, the highest number 154 (40.1%) of the respondents attained primary school followed by secondary school 104 (27.1%) while there were only 10 (2.6%) who attained college or university level of education.

This was statistically significant association between malaria diagnostic test preference and level of education whereby respondents who never attended formal education and those with primary level or secondary level education were more likely prefer malaria RDT compared to those who attained college or university level of education (p=0.001) (Table 1).

Variables	Total, n (%)	Malaria test preference		Chi-Square test
		RDT (n=298)	Microscopy (n=86)	
Age in group				
19-23	12 (3.13%)	8 (66.70%)	4 (33.30%)	0.807
24-27	17 (4.41%)	14 (82.40%)	3 (17.60%)	
28-32	72 (18.75%)	55 (76.40%)	17 (23.60)	
33-37	76 (19.79%)	61 (80.30%)	15 (19.70)	
38-42	116 (30.21%)	86 (74.10%)	30 (25.90)	
43-47	40 (10.42%)	32 (80.00%)	8 (20.00%)	
48<	51 (13.29%)	42 (82.40%)	9 (17.60%)	
Sex				
Male	188 (49%)	146 (49%)	42 (48.8%)	0.98
Female	196 (51%)	152 (51.0%)	44 (51.2%)	
Marital status				
Married	284 (74.0%)	225 (75.5%)	59 (68.6%)	0.6
Single	37 (9.6%)	25 (8.4%)	12 (4%)	
Divorced	11 (2.9%)	8 (2.7%)	3 (3.5%)	
Widowed	35 (9.1%)	27 (9.0%)	8 (9.3%)	
Separated	17 (4.4%)	13 (4.4%)	4 (4.7%)	
Education level of respondents				
Never attend school	56 (14.6%)	50 (16.8%)	6 (7.0%)	0.001
Primary school	154 (40.1%)	125 (42.0%)	29 (33.7%)	
Dropped primary school	14 (3.6%)	12 (4.0%)	2 (2.3%)	
Dropout secondary school	46 (12.0%)	39 (13.1%)	7 (8.1%)	
Secondary school	104 (27.0%)	68 (22.9%)	36 (41.9%)	
College/University	10 (2.6%)	4 (1.3%)	6 (7.0%)	

Monthly incomes in Rwandan francs (Rwf)				
Lesser than 50,000 Rwf	174 (45.3%)	144 (48.3)	30 (34.9%)	0.002
Between 50,000 and 100,000 Rwf	135 (35.2%)	106 (35.6)	29 (33.7%)	
Between 101,000 and 200,000 Rwf	63 (16.4%)	43 (14.4%)	20 (23.3%)	
Above 200,000 Rwf	12 (3.1%)	5 (1.7%)	7 (8.1%)	
Health Insurance				
Community Based Health Insurance	322 (83.9%)	263 (88.3)	59 (68.6%)	0.001
Rwanda Social Security Board (RSSB)	51 (13.3%)	25 (8.4%)	26 (30.2%)	
Private Insurance	6 (1.6%)	5 (1.7%)	1 (1.2%)	
None	5 (1.3%)	5 (1.7%)	0 (0.0%)	

Table 1: Socio-demographic and socio-economic characteristics stratified by malaria test preference. Descriptive analysis of perceived benefits of using RDTs.

In relation to monthly income, the highest proportion of respondents 174 (45.3%) earned less than 50,000 Rwandan francs (Rwf) per month. Those were more likely to prefer RDT over microscopy compared to those with higher income who tended to prefer microcopy instead (p=0.002). Almost all 379 (98.7%) had health insurance and community based health insurance was the commonest type of health insurance 322 (83.9%). The proportion of RDT preference was significantly higher among respondents with community based health insurance compared to those who had Rwanda Social Security Board (p=0.001). Majority 372 (96%) and 300 (78.1%) of respondents cited fast diagnosis and cheap service respectively as the main benefits of using RDT for malaria diagnosis at the community level as shown in (Figure 2).

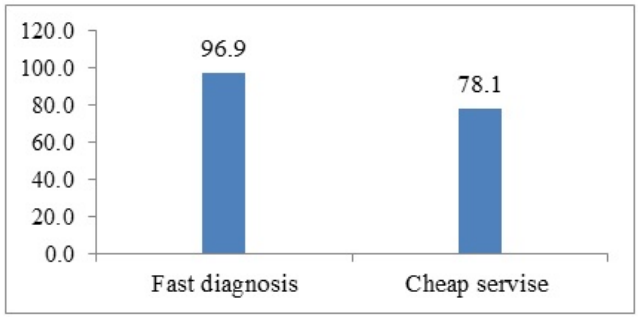

Figure 2: Perceived benefits of using RDTs.

Descriptive analysis of reasons for not accepting RDTs and suggestions to improve RDT for Malaria in the community

Respondents who preferred microscopy 73 (84.9%) were concerned about RDT results not being trustworthy or accurate; 66 (76.7%) had a fear about the ability of the CHW to perform RDT; 63 (73.3%) did not trust the capacity of the CHW to correctly interpret RDT results. When probed on their suggestions for improving the use of malaria RDTs, majority of the respondents 348 (90.6%) suggested that provision of pictorial job aid, 339 (88.3%) suggested more training, 318 (82.8%) suggested that CHWs should always look at the instruction before performing RDT test and 301 (78.4%) suggested a repeat test when RDT result is negative to improve the performance of RDT for malaria at community level and to avoid false negative results as shown in (Table 2).

Variable	Frequency	Percent
*Reasons for not accepting RDTs		
Fear of CHWs performance	66	76.7
Non trusted results	73	84.9
Low education level	49	57.0
RDT low accuracy	43	50.0
Fear of RDT interpretation	63	73.3
*Suggestion to improve RDT		
More training	339	88.3
Provision of pictorial job aid	348	90.6
Need always look at RDT instructions	318	82.8
Perform a repeat RDT test	301	78.4
*Multiple response (Counts/percentage do not add to the totals)		

Table 2: Descriptive analysis of reasons for not accepting RDTs and suggestions to Improve RDT for Malaria in the community.

Discussion

The present study found that Malaria RDTs were preferred (77.6%) over microscopy (22.4%). This high level of acceptability of RDTs was similar to other studies done in the East African region. Findings from a qualitative study conducted in Uganda by Mukanda et al. found a majority of community members; health workers and CMDs welcomed the use of RDTs by CMDs, provided that they are properly trained in their use. In the study, the high community acceptability of RDTs was partly due to the appreciation that CMDs would be able to

offer treatment, which was based on test results rather than just presence of symptoms and signs. A similar study in Sudan also found community acceptability of Coartem and RDTs in HMM to be high, with a marked increase in treatment-seeking behavior following the implementation [9].

Majority of the household heads in Rubavu District, prefer malaria RDT over microscopy. This could be partly due to the appreciation that RDTs enable the CHWs to offer malaria treatment based on test results rather than presence of signs and symptoms. This is in keeping with the study conducted in Uganda [9], which demonstrated that RDTs have the potential to greatly enhance the management of febrile illness. This is also related to the study in rural Ghana, which concluded that the Test (RDT)-based management of malaria in under-five children is likely to be acceptable to caregivers [8]. Regarding the association between health insurance status and malaria RDT acceptability, the study found that those not insured as well as those insured under the community based health insurance (Mutuel de santé) were more likely to accept malaria RDT compared to those with government health insurance. This difference can be partly due to the fact that the former find the malaria RDTs offered at the community level to be cheaper and more convenient to seeking health services in the government primary healthcare facilities whereas the latter, through their insurance additionally have access to private health facilities from where they can obtain alternative malaria diagnostic services.

The study found that as the level of education increased the acceptability of RDT reduced. Community members who never attended school, those with primary or secondary level of education were significantly more likely to prefer malaria RDT compared to those attained college or tertiary level of education (p=0.001). Most CHWs in Rwanda have primary level of education; hence community members with higher level of education may feel that the CHWs level of knowledge on the test is equally low. Similarly, respondents with low monthly income were significantly more likely to prefer malaria RDT to microscopy while those with high income preferred microcopy (p=0.002). The descriptive findings of the study suggest the following reasons for not accepting RDTs: CHWs low education level, fear of CHWs performance, unreliable results, perceived low accuracy of RDTs and fear of wrong RDT interpretation by CHWs. These findings are resonant with those of a study done in Nigeria, which suggested that community members do not trust the results despite the fact that RDTs have been found to have a high sensitivity and specificity [10]. Additionally, findings from this study that community members preferred RDT to microscopy because it is cheap and fast are related to those by Chinwe et al. in a study done in Port Harcourt and Obio/Akpor, Rivers State of Nigeria which found malaria RDTs were perceived to be time saving and give better results and hence better diagnosis [11]. Diggle et al. also recorded that respondents preferred RDT due to its perceived ease and swiftness of use, portability and non-reliance on electricity. The authors also reported that the fact that RDTs can't quantify parasitaemia, while some only detect *P. falciparum* and are not always reliable were some of the reasons for non-acceptance of malaria RDTs [12,13].

Conclusion

RDTs are a valuable adjunct to microscopy for the diagnosis of malaria; in addition, malaria RDTs have high sensitivity and are the preferred method for the diagnosis of malaria by communities in Rubavu District, Rwanda. This test is more acceptable by households heads with low level of education, low monthly income and families that depend on community based health insurance. In order to increase acceptability of RDT for malaria among community members with high level of education, CHWs should be selected from community members who have higher level of education.

Author's Contribution

Gashegu Misbah: Conceptualized the idea for the study, contributed in design and protocol preparation, performed analysis and interpretation of data and drafted the first manuscript.

Benon Asiimwe: Contributed in the design and protocol preparation, involved in acquisition of data and participated in critical review of the subsequent draft of the manuscript

Michael Habtu: Provided assistance with the design, analysis and interpretation of data and participated in critical review of the subsequent draft of the manuscript

Monica Mochama: Assisted in design and participated in critical review of the subsequent draft of the manuscript

Catherine Kansiime: Made a substantial contribution toward analysis and participated in critical review of the subsequent draft of the manuscript.

Each author has given final approval of the version to be published.

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