

# Use of Malaria Rapid Diagnostic Tests among Medical Doctors in a Tertiary Hospital, South East Nigeria

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## Abstract

Malaria is a major health problem in Nigeria that has as high as 25% of all global cases, and 30% of deaths attributable to malaria. In 2010, World Health Organization (WHO) recommended universal confirmation of diagnosis of malaria through blood parasitological test, prior to initiation of treatment. In addition to Microscopy, Malaria Rapid diagnostic Tests (mRDTs) are blood tests for malaria. Early diagnosis of malaria ensures that the correct treatment is commenced in good time, and this subsequently improves the prognosis. The objective of this study is to assess the use of mRDTs among medical doctors working in a tertiary hospital, Southeast Nigeria. This study was conducted in Enugu State Teaching hospital, Southeast Nigeria. The study was of cross-sectional design, and conducted in October 2016 among medical doctors working in the General Outpatient, Internal Medicine, and Paediatrics departments of the Teaching hospital. Statistical Package for Social Sciences (SPSS) version 20.0 was used for data analysis. A total of 86 medical doctors, out of the eligible 91 in the three departments participated in the study, and were distributed as follows; 24 (27.9%) in the General Outpatient, 30 (34.9%) in the Internal Medicine, and 32 (37.2%) in the Paediatrics departments. More medical doctors in the Paediatrics department (31.3%) used mRDTs in making diagnosis of malaria, followed by Internal medicine (13.3%), then General Outpatient Department (8.3%). Malaria rapid diagnostic tests are cost-effective, and useful tools in malaria control and elimination programmes. If tangible progress on the implementation of the WHO guidelines on confirming diagnosis of malaria before treatment; and the T3: Test, Treat, Track initiative is to be made; then the government and the Management of hospitals ought to take more determined efforts aimed at educating and informing health workers, especially medical doctors on the benefits of mRDTs.

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## Keywords

Use, Malaria, Rapid, Test, Doctors

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### 1. Introduction

Malaria is a disease caused by infection of red blood cells with a parasite known as *Plasmodium*. The infection is transmitted through the bite of a female Anopheles mosquito, with fever as the commonest presenting sign [1]. Usual clinical symptoms of malaria include fever, weakness, chills, headache and malaise [2]. There are four main species of *Plasmodium*, which are *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae* and *Plasmodium ovale*, that cause malaria. Occasionally, malaria was reported to have been caused in the forest region of South-East Asia by a rare species of *Plasmodium* known as *Plasmodium Knowlesi* [2]. This disease predominantly occurs in the WHO African Region, which account for about 90% of cases and malaria death globally [3]. The incidence of malaria cases has been on the decline globally since 2010, but the rate of this trend has reduced, with some WHO regions even recording an increase in the incidence since 2014. Globally in 2016, 216 million cases of the disease was reported in 91 countries. This represents an increase from the 2015 figure of 212 million. In 2016, the number of death globally rose from 429,000 which was recorded in 2015 to 445,000 [3]. Malaria is still a significant public health problem in Nigeria, with the country having as high as 25% of all global malaria cases, and 30% of deaths attributable to malaria [4]. About 97% of the population in Nigeria are at risk of malaria infection, with about 51 million cases and 207,000 deaths recorded yearly [5].

In an effort to encourage home management of malaria in the past, presumptive treatment of malaria was advocated and caregivers were taught to initiate malaria treatment at home before presenting in a health facility, once a child developed fever [6]. Malaria diagnosis was then mostly based on clinical presentation. However in 2010, World health Organization recommended universal confirmation of diagnosis of malaria, prior to initiation of treatment [7]. This confirmation is usually done through blood parasitological test, which can be microscopy or rapid diagnostic test [7]. Using mRDT to make diagnosis of malaria is based on detecting malaria parasite antigens in the human blood [8]. Malaria rapid diagnostic test tool usually is made up of a colorimetric assay kit of nitrocellulose strip encased in a plastic cassette. The test is done by adding a blood sample of the patient in an opening on the test cassette, and dropping specified quantity of buffer in another opening. After 15 to 20 minutes, the result is interpreted. Positive result is indicated by the appearance of another band in addition to the one that will appear in the "Control" section of the result chamber [1]. There has been significant use of mRDT to confirm diagnosis of malaria in public health facilities since 2010, with the highest increase occurring in the WHO

African region where the use of mRDT increased from 36% in 2010 to 87% in 2016. Malaria rapid diagnostic testing accounted for 63% of all malaria diagnostic testing in this WHO African region in 2016 [3]. The World Health Organization in 2012 launched a Global Malaria programme known as *T3: Test, Treat, Track* initiative. This programme is designed to encourage and promote testing of all suspected malaria cases before treatment, and reporting all malaria cases [9]. The initiative is also aimed at fast-tracking the achievement of universal testing of suspected malaria cases prior to commencement of treatment, as was enunciated by WHO in 2010. In public health facilities in malaria endemic countries, confirmation of malaria through microscopy usually takes more than one day, with the resultant effect of lengthy Turn-Around-Time for malaria diagnosis. This is commonly due to inadequate trained Laboratory Scientists and few microscope. The recommended Turn-Around-Time for malaria diagnosis is two hours [7]. Another advantage of mRDT is its potential to be used as Point-Of-Care test for the management of fever cases in malaria endemic areas, because trained Laboratory Scientists and equipment are not required for the conduct of the test [10].

The usefulness of mRDT in preventing death resulting from malaria is well documented [7] [11]. Early diagnosis of malaria ensures that the correct treatment is commenced in good time, and this subsequently improves the prognosis for the desired outcome. However, some researchers reported that some health care providers do not comply with the mRDT results when managing fever cases, because they believe that negative results do not rule out malaria infection. They believe that they possess enough clinical skill to make a diagnosis of malaria [12]. More qualified health care providers such as medical doctors were documented by some authors to have higher inclination to prescribing anti-malaria medication in spite of negative mRDT results [13].

About 110 million clinically diagnosed malaria cases occur each year. This obviously is a burden on health system and also costs about 480 billion Naira in out-of-pocket treatments, prevention costs, and loss of man hour [14]. This estimate of 110 million, probably might not be reliable since it was not completely based on parasitologically confirmed cases of malaria. Full implementation of the WHO T3 initiative in Nigeria will translate into reduction of the amount spent in procuring anti-malaria drugs, since the drugs will now be given to only those with parasitologically confirmed diagnosis of malaria. It is therefore very important that all health workers, especially medical doctors use mRDT as Point-Of-Care test for the confirmation of malaria, prior to treatment [10]. Currently in the two Teaching Hospitals in Enugu State where this study was conducted, mRDT is not used as Point-Of-Care tool to confirm malaria prior to treatment. This probably is the same situation in many Teaching hospitals in Nigeria. If the implementation of the World Health Organization's T3 initiative is to be achieved in this part of the world, it is very important that the use of mRDT by doctors working at the apex referral facilities is assessed, with the

purpose of identifying gaps, and developing strategies that shall aid in improving the use of mRDT among medical doctors. The main objective of this study is to assess the use of malaria rapid diagnostic test among medical doctors working in a tertiary hospital, Southeast Nigeria.

### **Limitation of the Study**

There were disproportionate numbers of doctors in the different professional ranks across the departments. House Officers were found only in the Internal Medicine department (36.7% of respondents from the department), while Medical Officers were found only in the General Outpatient department (16.7% of respondents in the department). House Officers are newly qualified medical doctors, who usually are not expected to have adequate knowledge on the mRDT and the use, when compared to senior ranks of the medical profession. This possibly could affect the overall findings in the Internal Medicine department. Same can be said of the General Outpatient department where all the 4 Medical Officers worked. These Medical Officers were not in training, and probably might not have been making efforts to improve their knowledge. Respondents from some ranks such as Senior Registrar in Internal Medicine are very few, hence limiting the reliability of the finding as representative of the use among Senior Registrars. It was not possible to recruit more respondents into the study, since it was a whole population study.

## **2. Methodology**

Enugu state is made up of seventeen Local Government Areas, and is one of the five states that make up the Southeast geo-political zone of Nigeria. She has about 436 public health facilities among which are two teaching hospitals that serve as apex referral centres for malaria cases [15]. This study was conducted in Enugu state government owned Teaching hospital, which has full approval by the relevant regulatory bodies to provide full complement of services obtainable in any recognized Teaching hospital in Nigeria. There is however, provision of Point-Of-Care diagnosis of malaria in only Paediatrics department of the hospital. Parasitological diagnosis of malaria was mainly through microscopy, though mRDTs were done in cases where the word "URGENT" was marked on top of the laboratory request form. The study was of observational, descriptive, cross-sectional design; conducted among medical doctors working in the General Outpatient, Internal Medicine, and Paediatrics departments in October, 2016. These are the three departments that manage malaria cases that present in the hospital.

The inclusion criteria for this study were that the respondent must be a medical doctor of any rank, except Professor, employed by the Enugu State University Teaching Hospital; and working in either the General Outpatient, the Internal Medicine, or the Paediatrics department of the hospital. One Professor was in the General Outpatient department, while another one was in the Paediatrics

department. Internal Medicine department had no Professor. These two Professors were not involved in the routine provision of health services in the departments, hence they were excluded from the study. All medical doctors in the tertiary hospital, who were not working in the three listed departments were also excluded from the study.

The study was a whole population study, and self administered, structured questionnaire was used to collect information from the respondents. The questionnaire was broadly divided into two sections, with the first section eliciting information on the socio-demographic variables of the respondents, including professional ranks; while the second section was devoted to questions on whether diagnosis of malaria was usually confirmed prior to initiation of treatment, the method of making the diagnosis, and the use of mRDT in making a diagnosis of malaria. This second section also sought information on the pattern/frequency of using the different malaria diagnostic methods. The information collected were analyzed using SPSS version 20.0 for windows. The analysis was done in terms of the percentage of various methods used by doctors of different ranks in the different departments, in making a diagnosis of malaria; and the regularity of requesting for mRDTs.

Ethical clearance for this study was obtained from the Research Ethics committee of the Enugu State University Teaching Hospital. Consent was obtained from each respondent prior to the administration of the questionnaire, and assurances of utmost confidentiality in handling the information obtained was given to the respondents. Wide margin between the number of doctors in different ranks in the three departments could be a limitation to the findings from this study.

### 3. Results

A total of 91 medical doctors were eligible for the study and they were all given questionnaire. Eighty six of them (94.5%) returned the completed questionnaire. The distribution according to departments were 1) General Outpatient = 24 (27.9%), 2) Internal Medicine = 30 (34.9%), 3) Paediatrics = 32 (37.2%).

**Socio-demographic characteristics of respondents:** Equal number of respondents from both sexes participated in this study, with most of them (73.2%) falling within the age range of 31 to 45 years. All of them were of the Christian religious faith, with 96.5% of them being of the Igbo tribe, and 89.5% married. More than half (60.5%) were Registrars, while only 4.7% were medical Officers. All the 4 Medical Officers worked in the General Outpatient department.

**Usual means of making a diagnosis of malaria by medical doctors across the three departments:** More than 50% of all the respondents across the three departments (54.7%) usually made diagnosis of malaria based on clinical symptoms and microscopy. This was followed by the use of Clinical symptoms, and clinical symptom plus malaria rapid diagnostic test; each of them recording 40.7%. The use of malaria rapid diagnostic test alone recorded the least score of

18.6%, while the use of microscopy alone recorded 19.8%. Doctors in the Internal Medicine department recorded highest percentage (43.3%) in using clinical symptoms alone in making malaria diagnosis. Those in the Paediatrics department recorded highest in the use of malaria rapid diagnostic test (31.3%), and clinical symptoms plus mRDT (75%); while doctors in the General Outpatient department recorded the highest percentage score in the use of clinical symptoms plus microscopy (75%), and microscopy alone (20.8%).

**Pattern of request for malaria Rapid Diagnostic before treating suspected case of malaria:** Doctors in the Internal Medicine department recorded highest score on those that NEVER requested for mRDT (46.7%), and those that RARELY requested for mRDT (53.3%). Those in General Outpatient recorded highest percentage score on OCCASIONALLY requesting for mRDT before treatment (54.2%); while those in the Paediatrics department recorded the highest percentage score on FREQUENTLY requesting (50%), and ALWAYS requesting (21.9%).

**Usual means of making a diagnosis of malaria by medical doctors in the General Outpatient department:** Majority of doctors working in the General Outpatient department (75%) make diagnosis of malaria based on clinical symptoms plus microscopy, while only 8.3% reported that they make diagnosis of malaria based on rapid diagnostic test. Less than half of the doctors in the General Outpatient department (41.7%) reported making malaria diagnosis based on clinical symptoms, 20.8% based on microscopy, and 25% based on clinical symptoms plus rapid diagnostic test

**The Usual means of making a diagnosis of malaria by medical doctors in the Internal Medicine department:** More than half of the doctors working in the Internal Medicine department (56.7%) also make diagnosis of malaria based on clinical symptoms and microscopy, while 13.3% of them make diagnosis based on rapid diagnostic test. Less than half (43.3%) make diagnosis based on clinical symptoms, 20% based on microscopy, and 16.7% based on clinical symptoms plus malaria rapid diagnostic test.

**The Usual means of making a diagnosis of malaria by medical doctors in the Paediatrics department:** Most of the doctors in the Paediatrics department make diagnosis of malaria based on clinical symptoms plus malaria rapid diagnostic test (75%), while 31.3% base diagnosis of malaria on rapid diagnostic test only. Basing malaria diagnosis on clinical symptoms only, and clinical symptoms plus microscopy recorded 37.5% of the doctors in each instance; while 18.8% of the doctors in the Paediatrics department base malaria diagnosis on microscopy only.

#### 4. Discussion

It is the duty of medical doctors working in tertiary hospitals to manage fever cases. The usual departments in the tertiary hospitals involved with managing these cases are General Outpatient, Internal Medicine, and Paediatrics depart-

ments. Assessment of the use of mRDTs by doctors working in these departments was conducted with the main objectives of ascertaining the level of use, and identifying gaps that ought to be filled, if progress was to be made in implementing WHO T3 initiative of 2012 [9]. The three departments secured approval from the National Postgraduate Medical College of Nigeria, and the West African College of Physicians in no distant past, to train resident doctors; hence Registrars constituted the highest number of medical doctors that participated in the study. All the 11 (12.8%) House Officers that participated in the study were working in the Internal Medicine department, while all the 4 (4.7%) Medical Officers were working in the General Outpatient department (**Table 1**). These disproportionate distribution of ranks of respondents from the different departments could have affected the findings in some departments when compared to others, since the different ranks of doctors probably were not exposed to the same knowledge levels and opportunities to make use of mRDTs.

It was documented about ten years ago, that mRDTs are good tools in the point-of-care diagnosis and better management of malaria [10]. The finding in this study however revealed that mRDTs were the least used method in making diagnosis of malaria by the respondents (18.6%) (**Table 2**). As many as 40.7% of the respondents still using only clinical symptoms to make a diagnosis of malaria, does not show that any progress has been made in implementing the WHO 2010 guideline of confirming diagnosis of malaria, prior to treatment in this study area; since prior to the issuance of that guideline, it was found in the same study area that over 50% of malaria diagnosis was made presumptively [16]. Other health workers outside the medical doctors cadre were significantly part of making this 50% presumptive diagnosis of malaria. One would have expected the medical doctors to have bought into the use of mRDTs within a short period of time, as was found in a study in the same study area in 2010 when the WHO guideline on parasite-based malaria diagnosis came out [17]. In that same study [17], 31.1% of health care providers used mRDTs in making diagnosis of malaria. This is a lot more encouraging than the 18.6% found among medical doctors only, in this study. This discouraging finding in the study tertiary hospital, may not be unconnected with the finding that the Management of the hospital was not making any known efforts towards setting up point-of-care laboratories for mRDTs; and deliberately driving this WHO guideline of testing fever cases for malaria, before treating. Microscopy is the main malaria diagnostic tool in the study tertiary hospital, but occasional mRDT is performed in the main laboratory in cases of emergency. To use mRDTs, the medical doctor had to inscribe the word “URGENT” on the laboratory test request form.

One notable reason for not using mRDTs by health workers including medical doctors was the erroneous perception that mRDTs are not very reliable in making a diagnosis of malaria [17] [18] [19]. This could account for the practice by some medical doctors of prescribing anti-malaria medication to patients with negative mRDT result [20] [21] [22]. More medical doctors in this study (19.8%)



**Table 1.** Socio-demographic characteristics of respondents.

Respondents	N (%)
<b>Departments</b>	
General Out-Patient Department	24 (27.9)
Internal Medical Department	30 (34.9)
Paediatrics Department	32 (37.2)
<b>Sex</b>	
Female	43(50)
Male	43(50)
<b>Age at last birthday</b>	
Less than 24years	0(0)
24 - 30 years	16 (18.6)
31 - 35 years	29 (33.7)
36 - 40 years	24 (27.9)
41 - 45 years	10 (11.6)
46 - 50 years	2 (2.3)
51 - 55 years	1 (1.2)
56 - 60 years	3 (3.5)
61 yrs and above	1 (1.2)
<b>Tribe</b>	
Igbo	83 (96.5)
Esan	2 (2.3)
Idoma	1 (1.2)
<b>Marital Status</b>	
Married	77 (89.5)
Single	6 (7.0)
Divorced/Separated	2 (2.3)
Widowed	1 (1.2)
<b>Religion</b>	
Christianity	86 (100)
<b>Professional Rank</b>	
House Officer (Fresh graduates. Only Provisionally registered to practice)	11 (12.8)
Registrar (Junior Resident Doctors)	52 (60.5)
Senior Registrar (Senior Resident Doctors)	8 (9.3)
Medical Officer (Doctors with only first degree. Not in training)	4 (4.7)
Consultant (Specialists with registerable Postgraduate qualification)	11 (12.8)
<b>Distribution of Professional Rank across the three departments</b>	
General Outpatient Department	



**Continued**

Registrar	12 (50.0)
Senior Registrar	5 (20.8)
Medical Officer	4 (16.7)
Consultant	3 (12.5)
<b>Internal Medicine Department</b>	
House Officer	11 (36.7)
Registrar	
Senior Registrar	1 (3.3)
Consultant	4 (13.3)
<b>Paediatrics Department</b>	
Registrar	26 (81.3)
Senior Registrar	2 (6.3)
Consultant	4 (12.5)

preferred making a diagnosis of malaria through the use of microscopy, when compared to the 18.6% that prefer using mRDTs (**Table 2**). This is similar to the finding in a qualitative study in Ghana, the same year this study was conducted, where health care providers in hospitals and larger health centres preferred making diagnosis of malaria through microscopy [19]. This study revealed that more medical doctors in the Internal Medicine Department (43.3%) made diagnosis of malaria by using clinical symptoms than doctors in any other department. This could be attributable to the fact that it is the only department that had House Officers participating in this study; and since House Officers are the lowest in rank among the medical doctors, they may not be sufficiently informed on the guidelines for making diagnosis of malaria. Medical doctors in the Paediatrics Department clearly made use of mRDTs (31.3%) in arriving at a diagnosis of malaria, more than doctors in the other two departments put together (**Table 2**). Paediatrics department was the only department that had point-of-care side laboratory attached to their outpatient clinic, hence more of the medical doctors working there had better opportunity of making use of mRDT. The explanation on the finding about the usual means of making a diagnosis of malaria by the medical doctors, could also apply to the finding on the pattern of request for mRDT before treating suspected cases of malaria.

The pattern of request revealed that medical doctors in the Internal Medicine Department recorded the highest percentages of those that “NEVER requested” for mRDTs, and “RARELY requested” for mRDTs before treating suspected cases of malaria. Also in keeping with the explanation given above, medical doctors in the Paediatrics department recorded highest percentages on “FREQUENTLY requesting” and “ALWAYS requesting” for mRDT before treating any suspected case of malaria.

Most doctors in the General Outpatient department only “OCCASIONALLY

requested” for mRDTs prior to treating any suspected case of malaria (**Table 3**).

It is worrisome that medical doctors in both Senior Registrar, and Consultant ranks working in the General Outpatient Department did not make use of mRDTs at all. These are the most senior ranks of doctors, and ought to have been in the forefront of propagating the use of mRDTs. Out of the 5 respondents in the Senior Registrar rank, 4 (80%) of them made diagnosis of malaria based on the clinical presentation, while the Consultants used microscopy mostly in making malaria diagnosis. mRDTs are more recent malaria diagnostic tool, hence they it is possible that the Consultants had not updated their knowledge on the use of mRDTs in making a diagnosis of malaria, or they simply perceive mRDTs results as being unreliable. None of the Medical Officers, and only 16.7% of Registrars from the General Outpatient Department made a diagnosis of malaria by using mRDTs (**Table 4**). The same reasons suggested in the case of Consultants could also apply here.

**Table 2.** Usual means of making a diagnosis of malaria by medical doctors across the three departments

Departments	In my service delivery point, I usually make a diagnosis of malaria based on				
	Clinical symptoms	Malaria Rapid Diagnostic test	Microscopy	Clinical symptoms plus microscopy	Clinical symptoms plus malaria rapid diagnostic test
General Out-Patient Department	10 (41.7%)	2 (8.3%)	5 (20.8%)	18 (75.0%)	6 (25.0%)
Internal Medical Department	13 (43.3%)	4 (13.3%)	6 (20.0%)	17 (56.7%)	5 (16.7%)
Paediatrics Department	12 (37.5%)	10 (31.3%)	6 (18.8%)	12 (37.5%)	24 (75.0%)
Total	35 (40.7%)	16 (18.6%)	17 (19.8%)	47 (54.7%)	35 (40.7%)

**Table 3.** Pattern of request for malaria rapid diagnostic test before treating suspected case of malaria.

Department	NEVER request	RARELY request	OCCASIONALLY request	FREQUENTLY request	ALWAYS request
General Outpatient	4 (16.7%)	5 (20.8%)	13 (54.2%)	6 (25.0%)	3 (12.5%)
Internal Medicine	14 (46.7%)	16 (53.3%)	12 (40.0%)	6 (20.0%)	3 (10.0%)
Paediatrics	4 (12.5%)	7 (21.9%)	5 (15.6%)	16 (50.0%)	7 (21.9%)
<b>Total</b>	22 (25.6%)	28 (32.6%)	30 (34.9%)	28 (32.6%)	13 (15.1%)

**Table 4.** The use of malaria rapid diagnostic test by doctors in the general outpatient department

Professional Rank	In my service delivery point, I make a diagnosis of malaria based on				
	Clinical symptoms	Malaria Rapid Diagnostic test	Microscopy	Clinical symptoms plus microscopy	Clinical symptoms plus malaria rapid diagnostic test
Registrar	3 (25%)	2 (16.7%)	1 (8.3%)	8 (66.7%)	4 (33.3%)
Senior Registrar	4 (80%)	0 (0.0%)	3 (60%)	4 (80%)	0 (0.0%)
Medical Officer	2 (50%)	0 (0.0%)	1 (25%)	3 (75%)	1 (25%)
Consultant	1 (33.3%)	0 (0.0%)	0 (0.0%)	3 (100%)	1 (33.3%)
TOTAL	10 (41.7%)	2 (8.3%)	5 (20.8%)	18 (75.0%)	6 (25.0%)

Majority of the medical doctors in the Internal Medicine department make diagnosis of malaria by using clinical symptoms and microscopy (56.7%). None of the four Consultants, and the one Senior Registrar in the department used mRDTs in making a diagnosis of malaria (Table 5). This again underlines the need to mount a sustained mRDTs awareness creating activities, to secure a buy-in of the higher ranks of the medical doctors into the use of mRDTs in compliance with the WHO guidelines. Majority of the House Officers made diagnosis of malaria based on clinical symptoms, and none of them made use of mRDTs. This is understandable, since they are the lowest rank of medical doctors and are expected to possess the least all round knowledge.

Though most of the respondents from the Paediatrics department (75%) combined clinical symptoms and mRDTs in making diagnosis of malaria, a good number of them (31.3%) used mRDTs alone in making a diagnosis of malaria. The Paediatrics department also recorded the least percentage of medical doctors (37.5%) that used clinical symptoms in making diagnosis of malaria. Two, out of the four Consultants in this department used mRDTs in making diagnosis of malaria (Table 6). This is encouraging, since this is the only department where some Consultants used mRDTs alone in making a diagnosis of malaria. It is possible that medical doctors in the Paediatrics department were exposed to more information on mRDT; may be through trainings, workshops or seminars. This assertion requires further research, so that whatever factors that enhanced the use of mRDTs among medical doctors in the Paediatrics department, could be made to apply to doctors in the other departments.

**Table 5.** The Usual means of making a diagnosis of malaria by doctors in the internal medicine department.

Professional Rank	In my service delivery point, I make a diagnosis of malaria based on				
	Clinical symptoms	Malaria Rapid Diagnostic test	Microscopy	Clinical symptoms plus microscopy	Clinical symptoms plus malaria rapid diagnostic test
House Officer	6 (54.5%)	0 (0.0%)	1 (9.1%)	4 (36.4%)	2 (18.2%)
Registrar	6 (42.9%)	4 (28.6%)	5 (35.7%)	9 (64.3%)	3 (21.4%)
Senior Registrar	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100%)	0 (0.0%)
Consultant	1 (25%)	0 (0.0%)	0 (0.0%)	3 (75%)	0 (0.0%)
TOTAL	13 (43.3%)	4 (13.3%)	6 (20 %)	17 (56.7%)	5 (16.7%)

**Table 6.** The Usual means of making a diagnosis of malaria by doctors in the paediatrics department.

Professional Rank	In my service delivery point, I make a diagnosis of malaria based on				
	Clinical symptoms	Malaria Rapid Diagnostic test	Microscopy	Clinical symptoms plus microscopy	Clinical symptoms plus malaria rapid diagnostic test
Registrar	11 (42.3%)	7 (26.9%)	4 (15.4%)	10 (38.5%)	21 (80.8%)
Senior Registrar	0 (0.0%)	1 (50%)	1 (50%)	1 (50%)	2 (100%)
Consultant	1 (25%)	2 (50%)	1 (25%)	1 (25%)	1 (25%)
TOTAL	12 (37.5%)	10 (31.3%)	6 (18.8%)	12 (37.5%)	24 (75.0%)

## 5. Conclusions

Malaria rapid diagnostic tests are very cost-effective when compared to the other malaria diagnostic methods, hence they are very useful tool in malaria control and elimination programmes [16] [23] [24]. Different studies conducted in Uganda, Ghana, Zanzibar, and Tanzania revealed that the use of mRDTs enhanced correct treatment of malaria more than microscopy [20] [25] [26] [27]. It is undoubtedly of paramount importance that medical doctors who primarily are responsible for managing malaria cases, especially the complicated ones; fully key into the use of mRDTs. It is particularly important for doctors working in tertiary health facilities, since they train medical students who eventually become medical doctors.

If tangible progress on the implementation of the WHO guidelines on confirming diagnosis of malaria before treatment, and the Test, Treat, Track initiative is to be made in this part of the world; then the government and the Management of hospitals ought to take more determined efforts aimed at educating and informing health workers, especially medical doctors about the benefits of mRDTs. In addition to sustained awareness creating activities, proper training on the handling and use of mRDTs by medical doctors and other health care providers in Enugu State, Nigeria ought to be embarked upon as recommended in the National Policy on Malaria Diagnosis and Treatment [28]. It is also important that government and management of the hospitals ensure availability of mRDT kits in the health facilities, and also set up point-of-care laboratories for malaria in General Outpatient, Internal Medicine, and Paediatrics departments of the hospitals.

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