Research Article

Assessment of compliance to WHO's Test, Treat and Track (T3) Initiative of Artemisinin-Combination-Therapy (ACT) among Pharmacists and Patent Proprietary Medicine Vendors in Urban and Rural Lagos, Southwest Nigeria

Adeola Olukosi[1], Bamgboye M Afolabi[1,2,3]*, Ajibaye Sola[1], James Ayorinde[1], Sabdat kama[1], Aina OO[1], Agomo CO[4], Musa AZ[1], Babatunde Salako[1]

[1]Nigerian Institute of Medical Research, 6 Edmond Crescent, Yaba, Lagos, Nigeria

[2]Health, Environment and Development Foundation, Surulere, Lagos, Nigeria

[3]African, Pan African Health Alliance and Collaborative, Salisbury, North Carolina, USA

[4]Department of Medical Microbiology, University of Lagos, Akoka, Lagos, Nigeria

Abstract

Background: Community pharmacies and Patent Proprietary Medicine Vendors (PPMVs) play key roles in case management of malaria at the community level. However, their compliance with the WHO Test, Treat and Track (T3) Initiative for effective management of malaria cases are poorly documented. This study assessed the degree to which community pharmacies and PPMVs comply with the T3 initiative in Mushin, an urban area and in rural area of Ikorodu in Lagos State, Nigeria

Methods: This was a cross-sectional exploratory study that collected data with a semi-structured questionnaire from pharmacies and PPMV outlets.

Results: A total of 136 drug outlets (75 in urban, 61 in rural settings), manned by 44 Pharmacists, 8 Pharmacy technicians, 15 Pharmacy assistants and 69 PPMVs participated in this survey. Most staff (73, 53.7%) was aged 21-30 years with more males (87, 64.0%) than females (49, 36.0%). In all, 51 (37.5%) had post-secondary education with only 3 (2.2%) having no formal education. Pharmacists were approximately five times more likely to have been trained on RDT/ACT use than PPMVs (χ^2=18.57, P-value=0.00002, OR=4.91, 95% CI: 2.34, 10.31), more in rural (χ^2=8.44, P-value=0.004, OR=5.60, 95% CI: 1.68, 18.70) than in urban (χ^2=5.23, P-value=0.02, OR=3.27, 95% CI: 1.17, 9.15) setting. Sale of ACT based on RDT test was slightly more likely among PPMVs than Pharmacists (χ^2=0.37, P-value=0.54, OR=1.44, 95% CI: 0.45, 4.62) in urban setting but more likely among Pharmacists than among PPMVs in rural setting (χ^2=0.71, P-value=0.40, OR=1.69, 95% CI: 0.50, 5.71). Overall, 102 (75.0%) respondents (52 from Pharmacies and 50 from PPMVs) reviewed their clients and 63.1% referred them to the hospital if they did not get better.

Conclusion: This study demonstrated that overall, the "Test, Treat and Track" initiative of the WHO was moderately implemented in both the urban and rural study sites. Pharmacists and allied professions in rural setting were trained on the use of RDT to diagnose malaria, but very few PPMVs in urban setting received such training. PPMV's should be further empowered in the urban settings to promote the T3 initiative.

Keywords: Artemisisnin-based combination therapy; On-the-job training; Rapid diagnostic test; Malaria; Test-Treat-Track initiative; Lagos

Introduction

The theme

"**The Road To 2020:** Mobilizing Private Sector in Nigeria's Fight Against Malaria" was a presentation by the National Malaria Elimination Program (NMEP) that aptly captures a necessity to harness the significant role played by private sector in meeting health needs of Nigerians [1]. This is especially as played by the pharmacies and PPMVs given the health seeking behavior of the people whose first point of call is the pharmacy or PPMV stores during a febrile illness [2]. That the Private Sector plays a significant role in health through the major role in the case management of malaria which is acknowledged and highly valued, but needs to be more coordinated and aligned with national priorities, to fast track progress of Nigeria's aspiration to have realized the ambitious target of pre-elimination by 2030 [3]. Case management of malaria is key in malaria control and indeed home management of malaria at the community level has long been considered beneficial in curtailing deaths occurring in children under the age of five in endemic countries [4]. In 2012, the WHO Global Malaria Programme proposed the evidence-based T3 initiative - Test, Treat and Track malaria, to support malaria-endemic countries. Efforts have been geared towards achieving universal coverage with diagnostic testing and antimalarial treatment, as well as in strengthening their malaria surveillance

systems [5]. To this end, empowerment status at the level of interface of health seeking behavior of members of the community needs to be reviewed regularly to be sure that the relevant policy guidelines are being applied so that interventions can be applied as needed. Malaria is a major public health problem and Nigeria is one of the High Burden to High Impact (HBHI) Initiative countries because it contributes, together with 11 other countries, 80% of global malaria burden [6]. Surveillance is key in targeting policies, strategies and resources, tailoring an optimal mix of tools to a range of settings. This approach will also help to tease out information that will align partners and engage sectors beyond health because success in high burden countries will translate to success globally. Malaria is a parasitic disease transmitted by female Anopheles mosquitoes Malaria illness is associated with high body temperature, chills, and flu-like symptoms. In most parts of the world where it is endemic, five species of malaria parasites - Plasmodium falciparum, P. vivax, P. ovale, P. malariae and P. knowlesi infect human hosts [7]. Of these, infection with P. falciparum is the most lethal and if not treated quickly, may result in death. Although malaria can be a deadly disease, illness and death from malaria can usually be prevented. Though significant progress was made in the reduction of malaria mortality by 29% between 2010 and 2015, in 2017 the number of malaria cases increased to 219 million clinical cases [8]. The World Health Organization estimated that approximately 228 million clinical cases of malaria occurred in 2018, and 405,000 people died of the disease, mostly African children [9]. In the same year, P. falciparum accounted for 99.7% of estimated malaria cases in the WHO African Region [10]. Public health services to reduce the risk of malaria burden in Nigeria is still unacceptably low, especially among vulnerable population such as children under the age of five and pregnant women living in hard-to-reach and difficult-to-access areas [11]. In Nigeria, malaria is responsible for approximately 60 percent of outpatient visits and 30 percent of admissions. It is also believed to contribute up to 11 percent of maternal mortality, 25 percent of infant mortality, and 30 percent of under-5 mortality. It is estimated that about 110 million clinically diagnosed cases of malaria and nearly 300,000 malaria-related childhood deaths occur each year in the country [12]. Accurate diagnosis and prompt effective treatment of malaria are cardinal measures taken to control malaria. WHO's recommendation on T3 - diagnostic testing (Test), treatment (Treat) and surveillance (Track) anchors its key policy messages that "every suspected malaria case should be tested, every confirmed case should be treated with quality-assured antimalarial medicine, and the disease should be tracked through a timely and accurate surveillance system" [13]. This study aimed to assess adherence of drug outlet staff in urban and rural setting of Lagos State to WHO's Test Treat and Track Initiative among different drug outlets in urban and rural Lagos, Southwest Nigeria. The objectives of the study were:

1. To evaluate the capacity ACT dispensers to test for malaria and track its clearance and

2. To assess training on RDT and ACT received by different cadres of drug outlet staff and

3. To document sales of ACT, use of RDT and tracking advise given to clients who purchase antimalarial medications at drug outlets in urban and rural settings of Lagos State, Nigeria.

Materials and Methods

Study area and sample selection

This was a descriptive cross-sectional study of availability of ACTs and RDTs in community pharmacies and PPMVs in two Local Government Areas (LGA), one urban Mushin, and one peri urban Ikorodu in Lagos State, Nigeria.

Study site

Lagos has the smallest land mass of all States in Nigeria. It is situated south west with an estimated population of 14,368,000 in 2020 although with its expansion onto the mainland west of the lagoon including Ikeja and Agege over 25 miles northwest of Lagos it is estimated to have a population of 21 million and is therefore the largest city in Africa. The state has 20 LGAs. The Mushin LGA is located right in the heart of Lagos State, 10 km north of the Lagos central business district. It is a densely populated mixed commercial and residential area with inadequate sanitation, low quality housing, occupies an area of 14.1 km², with an estimated population of 870,100 (1,312,517 according to the Lagos State 2006 census) and density of 61,929/km². There are eight comprehensive primary health centers as well as one tertiary facility, LUTH and being a commercial center has almost every street having one drug outlet or the other. These include an infusion of PPMVs. Historically and traditionally, Mushin is home to the Aworis, a sub-ethnic group of the Yoruba tribe but within the past 50 years has inhabitants mainly from all parts of the country. Mushin was purposively selected, being the LGA closest in proximity to NIMR with a profusion of PPMVs. Ikorodu LGA on the other hand is situated approximately 36 km north of Lagos on an area of 345 km² with a population density of 2,107/ km² . Within greater Ikorodu there are 57 public primary schools and 12 secondary schools. There are also several private nurseries, primary and secondary schools, and two tertiary institutions. Community pharmacies located in Mushin and Ikorodu were selected from the compendium of licensed pharmacists and pharmaceutical premises in Nigeria, and their addresses grouped according to their relative proximity. Each group of 5 pharmacies was then assigned to a pair of field assistants (questionnaire administrators) so that the questionnaire administrators worked on a group of closely located pharmacies. PPMVs that could be found were also explored and these were more easily found in Mushin than in Ikorodu. Twenty field assistants were trained to collect information using a semi-structured questionnaire. The survey tool captured information on the sociodemographic characteristics of the respondents, their level of training, dispensing practices and storage conditions of medications sold. Others sections completed included, supply and costs of the ACTs that is sold by each PPMVs or pharmacy including the availability of RDTs and the use of diagnostic results to dispense ACTs. In each store, only one staff, representing the drug store, was interviewed, such that the total number of respondents was the same number as the total number and types of drug store.

Definition: For the purpose of this paper, a Pharmacist is defined as someone who is professionally qualifies to prepare and dispense drugs. Pharmacy technician is someone is a title-protected, licensed health-care provider who performs pharmacy-related functions, working collaboratively with a licensed pharmacist.

A Pharmacy assistant or aid is someone who helps licensed pharmacist with administrative duties in running a pharmacy e.g. clerks or cashiers. Drug store attendants refer to those who are employed by PPMVs to man the stores or to attend to clients' demand for drugs. "Others" refer to those in nursing profession, managing directors of the store, patent medicine dealer, medical doctor, industrial chemist, laboratory technologist and non-health-related owner of the store.

Ethical consideration

Approval for this study was obtained from the Nigerian Institute of Medical Research Institutional Review Board [IRB-19-043]. Permission to conduct the study was also obtained from Pharmaceutical Council of Nigeria and the National Association of Patent and Propriety Medicine Dealers. Informed consent was obtained from study participants before administration of the survey tool.

Data analysis

Descriptive statistics such as mean, standard deviation and frequency distributions were used to summarize the findings. Comparison of Categorical variables such as sex, age group and educational level, were randomly selected (one rural and one urban) and presented as frequencies. Representative drug stores were selected by a combination of random and convenience sampling method to include community and hospital pharmacies, PPMVs and itinerant drug from each LGA. The significance of association between two variables was determined by 2-tailed student's t-test and differences were considered significant when P-value was ≤0.05. Chi-square with 95% Confidence interval was used to evaluate the differences between two proportions or rates. One-way analysis of variance (ANOVA) with Bonferroni adjustment or Kruskal-Wallis test was used to compare groups as appropriate. Data were presented as numbers and percentages for categorical variables, as mean with standard deviations for continuous variables and as tables and figures for all variables and as Tables, Figures, Graphs and Charts. . A P-value < 0.05 was regarded statistically substantial. STATA version 13.0 (STATA Inc., Texas, USA) was used for statistical analysis.

Results

The mean (± sd) age of the respondents was 31.3 ± 8.9years. There was no significant difference in mean age of the respondents in urban [31.5 ± 9.5 years] and rural [30.9±8.2 years] settings (P=0.35). There was a significant difference (χ^2=6.31, P=0.01) in the proportion of males (87, 64.0%) and females (49, 36.0%) and males were approximately 2½ more likely to be in urban setting than female respondents (OR=2.49, 95% CI=1.22, 5.11). In all, 51 (37.5%) of the respondents achieved post-secondary education, significantly more in rural (31, 50.8%) than in urban (20, 26.7%) setting (χ^2=8.31, P-value=0.004). There were higher proportions of singles (77, 56.6%) than married (57, 41.9%), Christians (124, 91.2%) than Moslems (11, 8.1%) and non-indigenes of the state (123, 90.4%) than indigenes (13, 9.6%). Of the 136 respondents surveyed, 75 (55.1%) were in the urban and 61 (44.9%) in the rural settings. The proportion of pharmacists (30, 49.2%) in rural setting was significantly higher (χ^2=14.21, P=0.0002) than that in urban setting (14, 18.7%) (Table 1).

Respondents in the urban setting were from 26 (34.7%) Pharmacy stores (with resident Pharmacists) and 49 (65.3%) Proprietary Patent Medicine Vendors (PPMV) stores without resident Pharmacists while respondents in the rural setting represented 44 (72.1%) Pharmacy stores with resident Pharmacist and 17 (27.9%) PPMVs stores without resident Pharmacists (Figure 1a-c). Within the study areas, rural drug stores were about 5 times more likely to be Pharmacy stores than urban drug stores (OR=4.88, 95% CI: 2.34, 10.17).

Overall, only 31 (22.8%) of the 136 staffs ever received on-the-job training including 25 (80.6%) in urban and 6 (19.4%) in rural settings (Table 2 and Figure 2a-c). Urban drug store staff were approximately 5 times more likely to have received training on the job than rural staff (χ^2=10.48, P-value=0.001, OR=4.58, 95% CI: 1.74, 12.09). Table 3 shows that the overall mean (± sd) duration of training in months was 51.7 (25.6) with a minimum of 1 month and a maximum of 96 month (Table 3). The mean duration of training for drugstore attendant and others were 18.0 (0.0) and 52.8 (25.2) months respectively. There was no significant difference

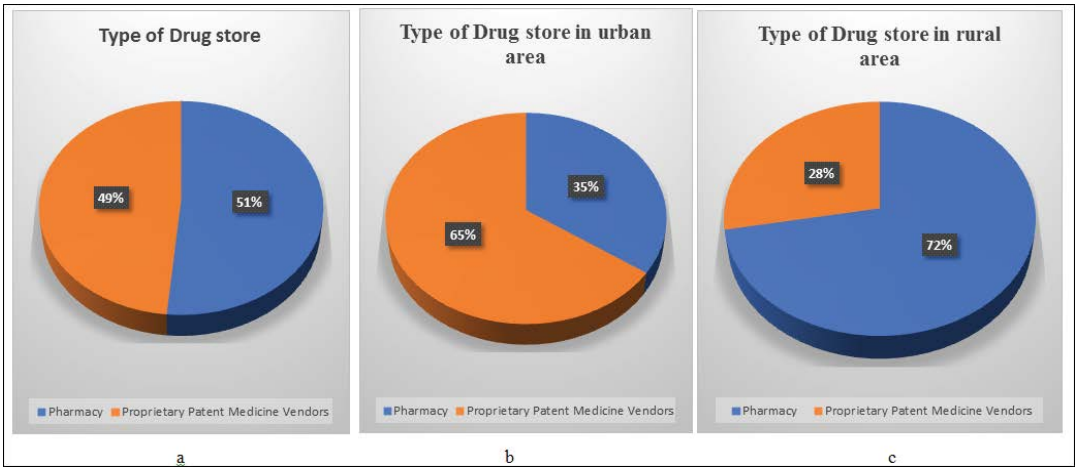

Figure 1: Proportion of Pharmacy and Proprietary Patent Medicine Vendors (PPMV) stores surveyed in both (a), urban (b) and rural (c) study areas in Lagos State, Nigeria (2019).
Note: In this study, rural (c) drug stores were about 5 times more likely to be Pharmacy than urban (b) drug stores (χ^2=18.8, P-value=0.00001, OR=4.88, 95% CI: 2.34, 10.17).

Table 1: Socio-demographic characteristics of respondents in the study

Variables		Items	All				Urban setting				Rural setting				t-test		Chi-square test			
			Freq.	%	Mean	±sd	Freq.	%	Mean	±sd	Freq.	%	Mean	±sd	t-test	P-value	χ^2	P- value	OR	95%CI
Age		Total	136	100	31.3	8.9	75	55.1	31.5	9.5	61	44.9	30.9	8.2	0.4	0.35	-	-	-	-
		≤20	9	6.6	19.1	1.2	5	6.7	18.4	1.1	4	6.6	20	0	-3.25	0.02	0.00*	1	1.02	0.26, 3.97
		21-30	73	53.7	26.2	2.8	41	54.7	26.5	2.8	32	52.5	25.8	2.8	1.06	0.15	0.07	0.8	1.09	0.56, 2.15
		31-40	32	23.5	35.4	3	17	22.7	35.4	3.3	15	24.6	35.4	2.8	0	1	0.07	0.79	0.9	0.41, 1.99
		41-50	18	13.2	45.1	2.8	8	10.7	45.4	2.7	10	16.4	44.9	3	0.52	0.31	0.95	0.33	0.61	0.22, 1.65
		≥51	4	2.9	55.5	6.4	4	5.3	55.5	6.4	0	0	-	-	-	-	-	-	-	-
Sex		Male	87	64	-	-	55	73.3	-	-	32	52.5	-	-	-	-	6.31	0.01	2.49	1.22, 5.11
		Female	49	36	-	-	20	26.7	-	-	29	47.5	-	-	-	-				
Education		None	3	2.2	-	-	2	2.7	-	-	1	1.6	-	-	-	-	0.00*	1	1.64	0.15, 18.57
		Primary	3	2.2	-	-	3	4	-	-	0	0	-	-	-	-	0.99*	0.32	undefined	undefined
		Secondary	50	36.8	-	-	41	54.7	-	-	9	14.8	-	-	-	-	22.89	0.000001	6.97	3.00, 16.16
		Post-secondary	51	37.5	-	-	20	26.7	-	-	31	50.8	-	-	-	-	8.31	0.004	0.36	0.17, 0.72
		Graduate	25	18.4	-	-	8	10.7	-	-	17	27.9	-	-	-	-	6.59	0.01	0.31	0.12, 0.78
		Others	4	2.9	-	-	1	1.3	-	-	3	4.9	-	-	-	-	0.52*	0.47	0.26	0.03, 2.58
Marital status		Single	77	56.6	-	-	41	54.7	-	-	36	59	-	-	-	-	0.26	0.61	0.84	0.42, 1.66
		Married	57	41.9	-	-	32	42.7	-	-	25	41	-	-	-	-	0.04	0.84	1.07	0.54, 2.13
		Divorces	1	0.7	-	-	1	1.3	-	-	0	0	-	-	-	-	0.00*	1	undefined	undefined
		Widowed	1	0.7	-	-	1	1.3	-	-	0	0	-	-	-	-	0.00*	1	undefined	undefined
Religion		Christian	124	91.2	-	-	71	94.7	-	-	53	86.9	-	-	-	-	1.66	0.2	2.68	0.77, 9.37
		Islam	11	8.1	-	-	3	4	-	-	8	13.1	-	-	-	-	2.63*	0.1	0.28	0.07, 1.09
		Traditional	1	0.7	-	-	1	1.3	-	-	0	0	-	-	-	-	0.00*	1	undefined	undefined
Indigene		Yes	13	9.6	-	-	6	8	-	-	7	11.5	-	-	-	-	0.47	0.49	0.67	0.21, 2.11
		No	123	90.4	-	-	69	92	-	-	54	88.5	-	-	-	-				
Duration of stay		**Indigene**	13	9.6	3.5	6.5	6	8	0	0	7	11.5	6.5	7.9	-	-	0.47	0.49	0.67	0.21, 2.11
		Non-indigene	123	90.4	8	9.1	69	92	9.5	10.3	54	88.5	6.2	6.8	-	-				
Profession	**Pharmacy**	**Pharmacist**	44	32.4	-	-	14	18.7	-	-	30	49.2	-	-	-	-	14.21	0.0002	4.22	1.96, 9.09
		Pharmacy technician	8	5.9	-	-	5	6.7	-	-	3	4.9	-	-	-	-	0.004*	0.95	0.72	0.17, 3.16
		Pharmacy assistant	15	11	-	-	6	8	-	-	9	14.7	-	-	-	-	1.55	0.21	1.99	0.67, 5.94
	PPMV	**Drug store attendant**	37	27.2	-	-	26	34.7	-	-	11	18	-	-	-	-	4.67	0.03	0.41	0.18, 0.92
		Others	32	23.5	-	-	24	32	-	-	8	13.1	-	-	-	-	6.62	0.01	0.32	0.13, 0.78

Median age (years) All=29.5; Urban=29.0; rural=30.0; Pharmacists=30.5; Pharmacy technicians=27.5; Pharmacy assistants-26.0; PPMVs=30.0: For Urban setting, median age (years) Pharmacists=29.5; Pharmacy technicians=25.0; Pharmacy assistants-26.0; PPMV=30: For semi urban setting, median age (years) Pharmacists=34.0; Pharmacy technicians=28.0; Pharmacy assistants-26.0; PPMV=25.0.

(t-test=0.53, P-value=0.31) in the mean (± sd) duration of training in the urban (52.8±25.7 months) and rural (47.0±26.9 months) settings. Figures 2a-c illustrate types of on-the-job training received overall and in both urban and rural locations. Only one drug attendant in urban setting received "other" types of on-the-job training which was not formal or informal (Figures 2a-c). Other category of occupation manning the drug stores received formal (33.3%), informal (50.0%) and other types of training (16.7%). Overall, 133 (97.8%) drug stores sold ACTs including 42 (95.4%) operated by Pharmacists, 1 (12.5%) by Pharmacy technicians, 15 (100.0%) by Pharmacy assistants, 36 (97.3%) by drugstore attendants and 32 (100.0%) by others (Figures 3a). However, of all the drug stores in the survey, only 42 (30.9%) had RDTs including 23 (52.3%) Pharmacists, 1 (12.35%) Pharmacy technicians, 6 (40.0%) Pharmacy assistants, 5 (13,5%) drugstore attendants and 7 (21.9%) of others. In the urban setting, all (100.0%) Pharmacy stores were selling ACT but only 42.9% of them had RDT while in the rural setting, 93.3% of Pharmacy stores were selling ACTs while 56.7% had RDTs (Figures 3a-c). In total, only 56 (41.2%) drugstore staff were trained (not on-the-job) on the use of RDT for the diagnosis of malaria. Majority of Pharmacists in the survey (31, 70.4%) followed by Pharmacy assistants (8, 53.3%) had received training on use of RDT. Pharmacists in the urban setting were equally as likely to be trained on RDT as those in rural setting (χ^2=0.0, P-value=1.0, OR=1.07, 95% CI: 0.24, 4.34) whereas Pharmacy assistants in rural setting were approximately 17½ times as likely to be trained on RDT compared to those in urban setting (χ^2=3.23, P-value=0.07, OR=17.50, 95% CI: 1.22, 250.4). While Government provided majority (7, 30.4%) of the training in urban area for those who were trained, individuals/ colleagues (8, 24.2%), NGOs (7, 21.2%) and Associations (7, 21.2%) provided most of the training in rural area (Figure 4). There was no significant difference in the proportion of drug store staff whose sale of ACT was based on RDT test in urban and rural settings (χ^2=0.41, P-value=0.52, OR=1.30, 95% CI: 0.58, 2.94). A higher proportion of rural (49, 80.3%) than urban (53, 70.7%) drugstores admitted inviting their clients to come back for a review though there was no overall statistical significance

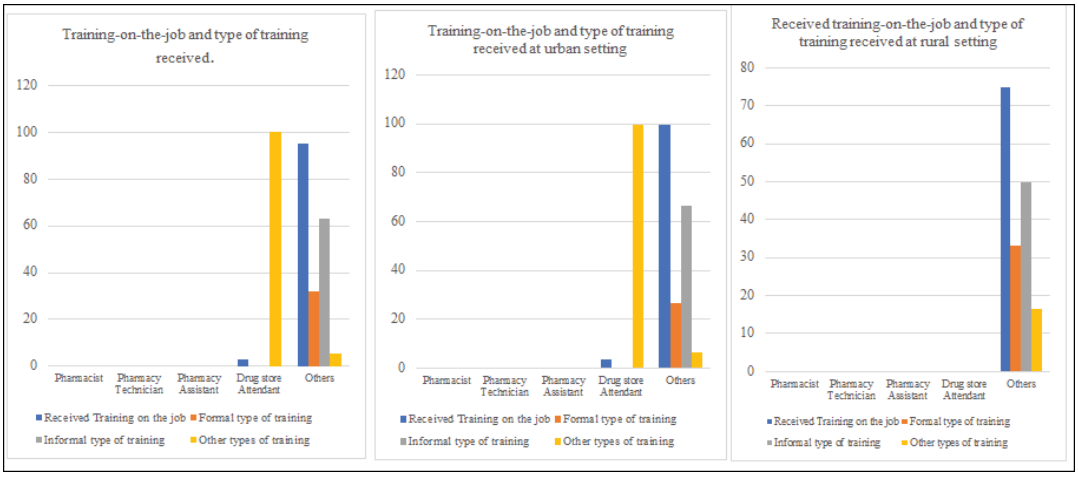

Figure 2a-2c: Types of training received by different categories of drug store staff.

Table 2: Training providers and proportion that received on-the-job training in urban and rural settings.

Variable		Location	Training provider	All		Pharmacist		Pharmacy Technician		Pharmacy Assistant		Drug store Attendant (PPMV)		Others	
				Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Received on-the-job training on RDT and ACT	**Yes**	-	-	31	22.8	0	0.0	0	0.0	0	0.0	1	2.7	30	93.8
	No	-	-	105	77.2	44	100.0	8	100.0	15	100.0	36	97.3	2	6.2
If yes, who was the training provider		**All**	Academic Institution	6	19.4	0	0.0	0	0.0	0	0.0	0	0.0	6	20.0
			Private organization	5	16.1	0	0.0	0	0.0	0	0.0	0	0.0	5	16.7
			Individual	20	64.5	0	0.0	0	0.0	0	0.0	1	100.0	19	63.3
		Urban	Academic Institution	3	12.0	0	0.0	0	0.0	0	0.0	0	0.0	3	12.5
			Private organization	4	16.0	0	0.0	0	0.0	0	0.0	0	0.0	4	16.7
			Individual	18	72.0	0	0.0	0	0.0	0	0.0	1	100.0	17	70.8
		Rural	Academic Institution	3	50.0	0	0.0	0	0.0	0	0.0	0	0.0	3	50.0
			Private organization	1	16.7	0	0.0	0	0.0	0	0.0	0	0.0	1	16.7
			Individual	2	33.3	0	0.0	0	0.0	0	0.0	0	0.0	2	33.3
In total, training providers were academic institutions (6, 19.4%, private organizations (5,16.1%) and individuals (20, 64.5%). In the urban and rural settings, training providers were academic institutions (3, 12.0%; 3, 50.0%)), private organizations (4, 16.0%; 1 16.7%)) and individuals (18, 72.0%; 2, 33.3%). Urban drug store staff were approximately 5 more likely to have received training on the job than rural staff (χ^2=10.48, P-value=0.001, OR=4.58, 95% CI: 1.74, 12.09).															

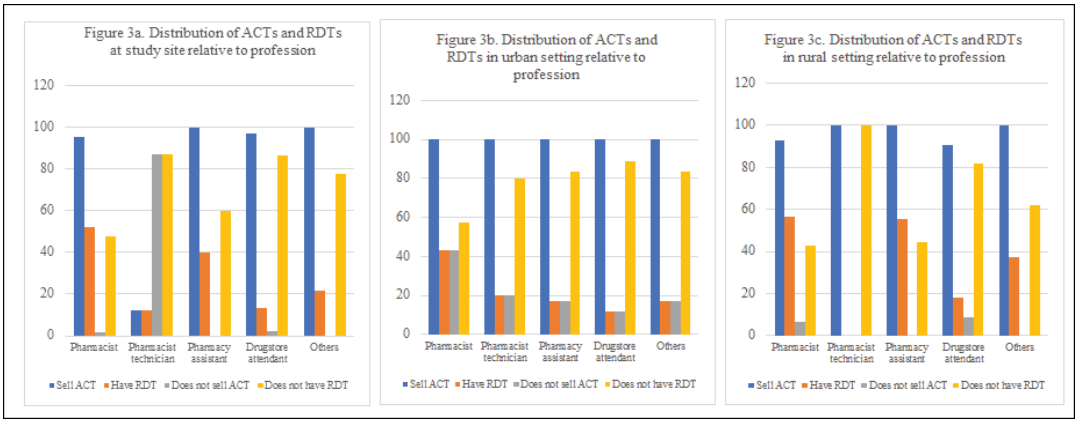

Figure 3a-3c: Distribution of ACTs and RDTs at different areas relative to profession.

Table 3: Cadre of staff, training received and training providers to personnel of pharmacy and PPMV in the study.

Variable	Sub-variable	All											
				Pharmacy						PPMVs			
		All		Pharmacist		Pharmacy Technician		Pharmacy Assistant		Drug store Attendant		Others	
		Mean (± sd)	Min./ Max	Mean (± sd)	Min./ Max	Mean (± sd)	Min./ Max	Mean (± sd)	Min./ Max	Mean (± sd)	Min./ Max	Mean (± sd)	Min./ Max
Duration of training (months)	All	51.7 (25.6)	1/96	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	18.0 (0.0)	18/18	52.8 (25.2)	1/96
	Formal	60.0 (22.8)	36/96	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	52.8 (25.2)	1/96
	Informal	52.9 (26.2)	1/96	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0
	Others	26.0 (9.2)	18/36	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	18.0 (0.0)	18/18	0 (0.0)	0/0
	F (P-value)	1.98 (0.16)		-		-		-		-		-	
Duration of store's existence (months)	All	95.1 (98.7)	0.5/540	109.5 (106.7)	0.5/540	78.0 (20.8)	60/96	89.9 (77.5)	12/240	97.5 (118.8)	6/480	79.9 (75.2)	1/360
	Pharmacy	105.4 (108.2)	0.5/540	109.3 (107.1)	0.5/540	78.0 (20.8)	60/96	86.4 (88.5)	10/240	101.3 (146.5)	12/480	141.6 (128.2)	24/360
	PPMVs	86.4 (89.9)	1/420	110.0 (112.8)	10/336	0 (0.0)	0/0	102.0 (25.4)	84/120	96.1 (110.6)	6/420	67.0 (55.0)	1/216
Urban													
Duration of training (months)	All	52.8 (25.7)	1/96	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	18.0 (0.0)	18/18	54.3 (25.1)	1/96
	Formal	66.0 (25.0)	36/96	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	18.0 (0.0)	18/18	66.0 (25.0)	36/96
	Informal	53.4 (24.9)	1/96	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	53.4 (24.9)	1/96
	Others	21.0 (4.2)	18/24	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	24.0 (0.0)	24/24
	F (P-value)	2.29 (0.12)		-		-		-		-			
Duration of store's existence (months)	All	109.1 (114.5)	1/540	142.6 (144.2)	33/540	78.0 (25.4)	60/96)	148.0 (81.7)	84/240	113.4 (133.6)	6/480	86.1 (80.9)	1/360
	Pharmacy	166.5 (148.0)	33/540	150.3 (155.9)	33/540	78.0 (25.4)	60/96	240.0 (0.0)	240/240	216.0 (228.9)	72/480	200.0 (138.6)	120/360
	PPMVs	86.7 (90.8)	1/420	108.0 (101.8)	36/180	0 (0.0)	0/0	102.0 (25.4)	84/120	99.4 (117.1)	6/420	69.1 (56.6)	1/216
Rural													
Duration of training (months)	All	47.0 (26.9)	6/84	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	47.0 (26.9)	6/84
	Formal	48.0 (17.0)	36/60	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	48.0 (17.0)	6/84
	Informal	50.0 (39.9)	6/84	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	50.0 (39.9)	6/84
	Others	36.0 (0.0)	36/36	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	0 (0.0)	0/0	36.0 (0.0)	36/36
	F (P-value)	0.06 (0.94)		-		-		-		-			
Duration of store's existence (months)	All	75.1 (66.8)	0.5/336	92.9 (81.2)	0.5/336	78.0 (25.4)	60/96	60.8 (62.4)	12/180	53.3 (40.3)	12/120	56.0 (44.7)	12/132
	Pharmacy	71.0 (55.7)	0.5/228	86.3 (61.8)	0.5/228	78.0 (25.4)	60/96	60.8 (62.4)	12/180	44.0 (39.2)	12/120	54 (42.4)	24/84
	PPMVs	85.2 (90.5)	10/336	110.7 (125.5)	10/336	0 (0.0)	0/0	0 (0.0)	0/0	72.0 (43.3)	36/120	57.0 (52.2)	12/132

(χ^2=1.73, P-value=0.42). There was a significant difference (χ^2=6.39, P-value=0.01, OR=2.49, 95% CI: 1.22, 5.07) in the proportion of drugs store staffs in urban area who referred patients to health facilities for further management (54, 72.0%) compared drug store staffs in rural area (31, 50.8%). Further, urban staffs were approximately 2½ times more likely to refer malaria patients to health facilities than those in rural setting.

Discussion

Since the advent of Test, Treat and Track initiative of the World Health Organization, most countries in malaria-endemic African Region including Nigeria, have updated their malaria diagnosis and treatment policy for case management to include diagnosis of all suspected malaria and febrile illnesses for presence of parasite

Table 4: Training, type of training on and training provider of RDT/ACT in urban and rural settings in the survey (2019).

Variable	Sub-variable	All											
		All		Pharmacist		Pharmacy technician		Pharmacy assistant		PPMV			
										Drug store attendant		Others	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Were you trained on RDT/ACT use*	**Yes**	56	41.2	31	70.4	1	12.5	8	53.3	7	18.9	9	28.1
	No	80	58.8	13	29.6	7	87.5	7	46.7	30	81.1	23	71.9
If Yes, what type of training did you receive	**Workshop**	21	37.5	14	45.2	0	0.0	2	25.0	3	42.9	2	22.2
	On the job	26	46.4	12	38.7	1	100.0	6	75.0	3	42.9	4	44.5
	Others	9	16.1	5	16.1	0	0.0	0	0.0	1	14.2	3	33.3
Who provided your RDT/ACT use training	**Government**	11	19.6	6	19.4	0	0.0	1	12.5	2	28.6	2	22.2
	NGOs	10	17.9	6	19.4	0	0.0	2	25.0	2	28.6	0	0.0
	Colleague	12	21.4	3	9.7	0	0.0	5	62.5	1	14.3	3	33.3
	Self-training	6	10.7	5	16.1	0	0.0	0	0.0	0	0.0	1	11.1
	Association	9	16.1	7	22.6	0	0.0	0	0.0	1	14.3	1	11.1
	Others	8	14.3	4	12.9	1	100.0	0	0.0	1	14.3	2	22.2
Urban													
Were you trained on RDT/ACT use*	**Yes**	23	30.7	10	71.4	1	20.0	1	16.7	6	23.1	5	20.8
	No	52	69.3	4	28.6	4	80.0	5	83.3	20	76.9	19	79.2
If Yes, what type of training did you receive	**Workshop**	7	30.4	3	30.0	0	0.0	0	0.0	3	50.0	1	20.0
	On the job	12	52.2	5	50.0	1	100.0	1	100.0	2	33.3	3	60.0
	Others	4	17.4	2	20.0	0	0.0	0	0.0	1	16.7	1	20.0
Who provided your RDT/ACT training	**Government**	7	30.4	3	30.0	0	0.0	0	0.0	2	33.3	2	40.0
	NGOs	3	13.0	1	10.0	0	0.0	0	0.0	2	33.3	0	0.0
	Colleague	4	17.4	2	20.0	0	0.0	1	100.0	0	0.0	1	20.0
	Self-training	2	8.7	1	10.0	0	0.0	0	0.0	0	0.0	1	20.0
	Association	2	8.7	1	10.0	0	0.0	0	0.0	1	16.7	0	0.0
	Others	5	21.7	2	20.0	1	100.0	0	0.0	1	16.7	1	20.0
Rural													
Were you trained on RDT/ACT use*	**Yes**	33	54.1	21	70.0	0	0.0	7	77.8	1	9.1	4	50.0
	No	28	45.9	9	30.0	3	100.0	2	22.2	10	90.9	4	50.0
If Yes, what type of training did you receive	**Workshop**	14	42.4	11	53.4	0	0.0	2	28.6	0	0.0	1	25.0
	On the job	14	42.4	7	33.3	0	0.0	5	71.4	1	100.0	1	25.0
	Others	5	15.2	3	14.3	0	0.0	0	0.0	0	0.0	2	50.0
Who provided your RDT/ACT use training	**Government**	4	12.1	3	14.3	0	0.0	1	14.3	0	0.0	0	0.0
	NGOs	7	21.2	5	23.8	0	0.0	2	28.6	0	0.0	0	0.0
	Colleague	8	24.2	1	4.8	0	0.0	4	57.1	1	100.0	2	50.0
	Self-training	4	12.1	4	19.0	0	0.0	0	0.0	0	0.0	0	0.0
	Association	7	21.2	6	28.6	0	0.0	0	0.0	0	0.0	1	25.0
	Others	3	9.1	2	9.5	0	0.0	0	0.0	0	0.0	1	25.0

Pharmacists were approximately five times more likely to have been trained on RDT and ACT than PPMVs (χ^2=18.57, P-value=0.00002, OR=4.91, 95% CI: 2.34, 10.31) ,more in rural (χ^2=8.44, P-value=0.004, OR=5.60, 95% CI: 1.68, 18.70) than in urban (χ^2=5.23, P-value=0.02, OR=3.27, 95% CI: 1.17, 9.15) setting.

before treatment [14]. This survey focused on five domains to demonstrate the status of the WHO T3 initiative in the case management of malaria in drug outlets in urban and semi urban Lagos.

(i) Cadre of personnel that received on-the-job-training

(ii) Cadre of personnel that received training on ACT and RDT use

(iii) Respondents that sold ACT based on RDT test and

(iv) Respondents that invited clients for a review after ACT sale and respondents that advise clients appropriately after diagnosis and treatment review. Those in pharmacy profession assistants outnumbered PPMVs in the study, though the proportion of PPMVs was equally high confirming the report from a prior study that this group of service providers represents a significant provider of healthcare in remote and rural areas [15] but also in densely-populated urban areas, responding to the needs of care-seekers. Proprietary patent medicine vendors (PPMVs) in Nigeria provide the main source of medicine for many common illnesses. The 14.8% proportion of rural respondents with secondary educational respondents in this study was lower than the 32.0% (8/25) reported in another rural study in the middle of the country [16]. With its dense population, the average pharmacist-patient ratio per clinic day in Lagos is suspected to be 1:100 putting a large strain on Pharmacists and leaving a gap of unattended care-seekers. The study results show that none of the Pharmacist respondents, Pharmacy technicians or Pharmacy assistants has received on-the-job training whereas approximately 45% of the PPMVs had received formal, informal or other types of on-

Table 5: Sales of ACT, use of RDT and tracking advise given to patients in the study areas.

Variable	Sub-variable	All		Pharmacy						PPMVs			
				Pharmacist		Pharmacy technician		Pharmacy assistant		Drug store attendant		Others	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
		All											
Is your sale of ACT based on RDT test	**Yes**	106	77.9	32	72.7	8	100.0	12	80.0	29	78.4	25	78.1
	No	30	22.1	12	27.3	0	0.0	3	20.0	8	21.6	7	21.9
Do you ask for a feed-back from the clients	**Yes**	102	75.0	35	79.6	6	75.0	11	73.3	29	78.4	21	65.6
	No	29	21.3	7	15.9	1	12.5	4	26.7	7	18.9	10	31.3
	Sometimes	5	3.7	2	4.5	1	12.5	0	0.0	1	2.7	1	3.1
What advise do you give your clients	**Try another antimalaria**	14	10.3	4	9.1	0	0.0	2	13.3	5	13.5	3	9.4
	Give antibiotics	18	13.2	7	15.9	0	0.0	2	13.3	3	8.1	6	18.8
	Refer to hospital	85	62.5	22	50.0	6	75.0	10	66.7	26	70.3	21	65.6
	Others	11	8.1	6	13.6	1	12.5	1	6.7	2	5.4	1	3.1
	Refer for lab test	8	5.9	5	11.4	1	12.5	0	0.0	1	2.7	1	3.1
Urban													
Is your sale of ACT based on RDT test*	**Yes**	60	80.0	10	71.4	5	100.0	4	66.7	21	80.8	20	83.3
	No	15	20.0	4	28.6	0	0.0	2	33.3	5	19.2	4	16.7
Do you ask for a feed-back from the clients	**Yes**	53	70.7	10	71.4	4	80.0	4	66.7	19	73.1	16	66.7
	No	19	25.3	4	28.6	1	20.0	2	33.3	6	23.1	7	29.2
	Sometimes	3	4.0	2	0.0	0	0.0	0	0.0	1	3.8	1	4.1
What advise do you give your clients	**Try another antimalaria**	8	10.7	2	14.3	0	0.0	1	16.7	3	11.5	2	8.3
	Give antibiotics	6	8.0	2	14.3	0	0.0	1	16.7	0	0.0	3	12.5
	Refer to hospital	54	72.0	7	50.0	5	100.0	4	66.6	20	76.9	18	75.0
	Others	4	5.3	1	7.1	0	0.0	0	0.0	2	7.7	1	4.2
	Refer for lab test	3	4.0	2	14.3	0	0.0	0	0.0	1	3.9	0	0.0
Rural													
Is your sale of ACT based on RDT test*	**Yes**	46	75.4	22	73.3	3	100.0	8	88.9	8	72.7	5	62.5
	No	15	24.6	8	26.7	0	0.0	1	11.1	3	27.3	3	37.5
Do you ask for a feed-back from the clients	**Yes**	49	80.3	25	83.3	2	66.7	7	77.8	10	90.9	5	62.5
	No	10	16.4	3	10.0	1	33.3	2	22.2	1	9.1	3	37.5
	Sometimes	2	3.3	2	6.7	0	0.0	0	0.0	0	0.0	0	0.0
What advise do you give your clients	**Try another antimalaria**	6	9.8	2	6.7	0	0.0	1	11.1	2	18.2	1	12.5
	Give antibiotics	12	19.7	5	16.7	0	0.0	1	11.1	3	27.3	3	37.5
	Refer to hospital	31	50.8	15	50.0	1	33.3	6	66.7	6	54.5	3	37.5
	Others	7	11.5	5	16.7	1	33.3	1	11.1	0	0.0	0	0.0
	Refer for lab test	5	8.2	3	10.0	1	33.3	0	0.0	0	0.0	1	12.5

*Sale of ACT based on RDT test was slightly more likely among PPMVs than Pharmacists (χ^2=0.37, P-value=0.54, OR=1.44, 95% CI: 0.45, 4.62) in urban setting but more likely among Pharmacists than among PPMVs in rural setting (χ^2=0.71, P-value=0.40, OR=1.69, 95% CI: 0.50, 5.71).

the-job training. There is a wide gap in on-the-job training for Pharmacists in Nigeria, which may be due to lack of sponsors, tight schedule of Pharmacists, or any other reasons. In the last 5 years, the Pharmaceutical Society of Nigeria (PSN) encouraged its members to participate in innovative scientific training termed Scientific Course for Pharmacist Education (SCOPE), aimed at enhancing the knowledge of Nigerian Pharmacists. Continuous Pharmacy Education is very important and central to higher pharmacy coverage and lower use of adulterated or expired drugs. The 25.0 median age (years) of PPMVs in this study is lower than the 47.5, 35.0 and 36.0 years reported by Durowade et al. at different study sites in Kwara State of Nigeria [16]. This is the age that these youths, mainly non-indigenes but with a minimum of secondary education, are expected to be at higher institution of learning but probably due to lack of financial support they either migrated or were lured to urban and rural areas to be engaged in running PPMV shops.

As expected, a high proportion of Pharmacists were trained on the use of RDT in testing for malaria while less than 20% of Drug store attendants and less than 30% of others were so trained. The low proportion of RDT end-users reported among the PPMVs in this study is similar to what Mukadi, et al. [17] reported. Lack of training on the use of RDT for malaria diagnosis is expected to lead to wrong diagnosis, buying a drug for the wrong illness, making a patient condition get worse and throwing the buyer deeper into poverty. This has a consequence on trust of the potency of medication and could lead to over-dosage and later reliance on improper use of unverified medicinal herbs. Maltha and Jacobs stated that end-user's errors are due to "safety, procedure (delayed reading, incorrect sample and buffer volumes) and interpretation (not recognizing invalid test results, disregarding faint test lines)" [18]. Another key finding is that the sale of ACT was based on RDT test in about 80% of cases. This was lower than the 100% RDT testing that was reported in Central Africa Republic by Ruckstuhl et al. [19]. Effective malaria control intervention, using the WHO 3Ts (Test, Treat, Track) may be jeopardized when each fever case is not confirmed as a malaria case before malaria

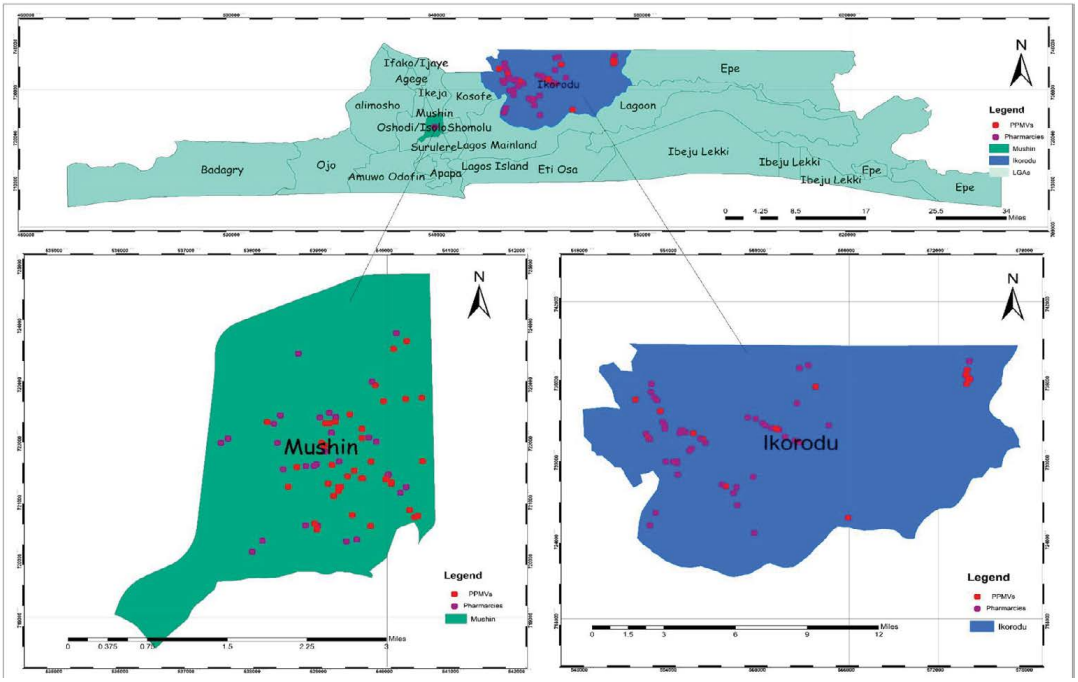

Figure 4: Map of Lagos state showing study sites (Mushin and Ikorodu) and location of PPMVs and Pharmacies visited.

treatment is administered. Overall, 62.5% of respondents would refer their clients to a hospital should such client not get well after consuming the ACT sold to him or her. This is discordant with a direct-observation report that only 0.4% of clients were referred [20] but falls within the 5%-68% of drug outlet staff would refer those with no improvement after initial treatment with ACT [21, 22]. Interestingly 47 (68.1%) of PPMVs, as against 38 (56.7%) Pharmacies responded that they would refer their client. A higher proportion of Pharmacies (16, 64.0%) in urban setting than in rural setting (22, 52.4%). The reason for this may be because regulatory bodies visit urban drug outlets more regularly than rural drug outlets.

Conclusion

This study demonstrated that overall, Pharmacists and allied professions were trained on the use of RDT to diagnose malaria, but very few PPMVs received such training and although almost all of the PPMVs sell ACTs, very few have RDTs. PPMVs are very important to fill the gap created by inadequate supply of Pharmacists but, regular and continuous capacity building on proper case management and a surveillance system that will include a referral system to keep the burden of malaria on a downward trend. Further, with regular training, PPMVs and even Pharmacists will be able to strictly adhere to WHO's Test, Treat and Track Initiative. This study recommends appropriate and adequate training of PPMVs in the rural setting on the use of RDTs for the diagnosis of malaria. A good supply chain system should be put in place for provision of RDT to complement availability of ACTs and strengthen the Test, Treat, and Track Initiative to control malaria in Nigeria.

Government at Federal and State levels and International Health Agents should support the Pharmaceutical Association of Nigeria to ensure that Pharmacists engage in continuous capacity building to familiarize them with WHO's policies and as an integral part of strengthening the health care system.

Study limitations

There are some limitations in this study that need further discussions. Sampled drug outlets in the urban area were more PPMVs than in the rural where the sampled drug outlets were mostly pharmacies. This discrepancy in affluence may have influenced the type of pharmacy stores that were surveyed, and the responses given. The respondents were not representatives of the overall Nigerian population and inferences deduced from the study should be limited to Lagos City-State.

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Address of Correspondence: Bamgboye M Afolabi, Adjunct Researcher/Chief Medical Research Fellow, Department of Biochemistry and Nutrition, Nigerian Institute of Medical Research, Yaba, Lagos, Nigeria, Tel: +2348030490729; Email: bmafolabi@gmail.com

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