Factors influencing practice regarding severe malaria among health workers in Central province, Papua New Guinea

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Abstract

Purpose - The objective of this study was to describe the current practice and to investigate factors influencing practice on severe malaria among health workers in Central Province, Papua New Guinea.

Design/methodology/approach - A cross-sectional study, with 142 participants were recruited and completed self-administered questionnaire during May 2018. Pearson chi-square and Fishers exact test were used to identify associations between independent and dependent variables; and logistic regression was used to control confounders and identify predictors on practice regarding severe malaria.

Findings - On-the-job training of health workers 6 months prior to the study was low (18.3%). Most participants (90%) had low-to-moderate knowledge of severe malaria. High knowledge (p=0.001, AOR=42.53, 95%CI=4.239-426.739) and high perceived benefits (p=0.015, AOR=6.25, 95%CI=1.422-27.47) were positive predictors of overall practice compared to low knowledge. Work experience >20 years was a negative predictor of overall practice (p=0.020, AOR=0.181, 95%CI=0.039-0.836). Age >50 years (p=0.001, AOR=0.17, 95%CI=0.062-0.463) and moderate knowledge (p=0.026, AOR=0.26, 95%CI=0.076-0.360) were negative predictors of diagnostic practice. Male sex (p=0.046, AOR=2.28, 95%CI=1.017-5.117) and high perceived benefits (p=0.042, AOR=2.52, 95%CI=1.032-6.187) were positive predictors of treatment practice. Income >K500 was negative predictor of compliant treatment practice compared to income <K500. Being married (p=0.012, AOR=6.325, 95%CI=1.491-26.840), positive attitude to responsiveness (p=0.017, AOR=5.846, 95%CI=1.370-24.943) and positive predictors of following up patients. Unfavorable cues were a strong negative predictor of following up severe malaria patients (p=0.005, AOR=0.153, 95%CI=0.041-0.575).

Originality/value - This is the first study in PNG exclusively focused on severe malaria. The study shows that level of knowledge and level of perceived benefits appear to have more effect on diagnosis and treatment of severe malaria.

Keywords Health belief model, Health workers' practice, Malaria, Papua New Guinea

Paper type Research paper

Introduction

Malaria is a disease caused by parasites of the genus *Plasmodia*, and it has been a global public health problem over the years, especially in endemic countries. In the last 15 years the world has seen a decline in malaria trends due to increased investments in malaria control. Between 2000 and 2015, the global malaria incidence dropped by 37% and mortality dropped globally by 48% [1]. The 2016 World Malaria Report shows a stall in the progresses made. PNG has witnessed similar trends; a decline from 2000 up until 2015and then a stall in 2016. Recent data shows resurgence in certain parts, notably in five provinces [2]. A negative

consequence of reduced exposure to malaria (over five years) is that populations in endemic areas loose immunity [3].

The current first and second line treatment of uncomplicated malaria in PNG are artemether lumefantrine and dihydroartemisinin piperaquine respectively. First and second line treatments of severe malaria are artesunate (or artemether) and quinine injection respectively [4].

Mortality from untreated or inappropriately treated severe malaria (particularly cerebral malaria) approaches 100% [5]. As such, how health workers respond to a patient suspected or diagnosed with severe malaria is important. So far, no specific study regarding health workers' practice on severe malaria has been done in PNG.

Therefore, the research objective was to study the current practice among health workers on severe malaria, and also identify factors influencing such practice.

Method

This was a health facility-based cross-sectional study among primary health workers in Central Province (PNG) using health belief model. Sample size was calculated using finite populations correction formula after Cochrane formula. The calculated sample size was 142. No additions to make up for losses were made as viable questionnaires were recouped until the required sample size was reached. Multistage sampling was used: firstly, 10 Central Province health facilities out of 20 were randomly selected. Then, convenient technique was applied where questionnaires were distributed to all staff on duty in the selected facilities. A self-administered questionnaire was used for data collection. The questionnaire had three parts of independent variables: Part 1 – Modifying variables (sociodemographic and economic factors, profession, and knowledge); Part 2 – Individual attitudes and Perceptions; Part 3 – Cues and Practice. The dependent variable (practice) was divided into overall practice, diagnosis, treatment and follow up, and each was dichotomized into compliant and non-compliant practices to the national guideline. Questions were constructed with reference from literature and national guidelines and validated by three malaria experts. The index-of-item objective congruence (IOC) score for internal validity after scoring by the three experts was 0.85. The Kuder-Richardson 20 (KR-20) score for reliability of items on knowledge was 0.712. Cronbach's alpha scores for reliability of items on attitudes and perceptions were 0.68 and 0.73 respectively. Analyses were done by descriptive statistics and inferential statistics using bivariate analysis (chi-squares and Fisher exact test), and multivariate analysis (logistic regression). Independent variables which showed significance in bivariate analysis at $p < 0.2$ ($p < 0.05$ inclusive) and variables which were significant in published studies were entered into the multivariate model.

Ethical approval was obtained from the Papua New Guinea Medical Research Approval Committee (MRAC No. 16.38).

Results

Among the 142 participants who completed the questionnaires, more than half (59.2%) were females. The mean age was 45 years and no participants were below 20 years. Younger workforce (<35 years) was the least represented (12.5%) and married participants comprised 81.0 % of the sample. All participants were Christians, however, only 63.0% attended church services. Almost half held social positions such as church and union leaders, or community group executives. Medical officers were the least represented (1.4%). More than 40.0% of the participants were middle-income earners (166.67– 333.33 USD; approximate purchasing power parity = 3.5). Most of the participants (60.0%) had low knowledge according to Bloom's criteria (<60.0%). In terms of attitudes, majority had neutral attitudes to

Table 1. Bivariate analysis of general characteristics of health workers with overall practice (n = 142)

Factors	Poor practice n (%)	Good practice n (%)	X^2	*p*-value
Sex			3.604	0.042
Male	28 (48.3)	30 (51.7)		
Female	54 (64.3)	30 (35.7)		
Age group in years				
<20	0 (0.0)	0 (0.0)	1.446	0.485
20 – 35	12 (66.7)	6 (33.3)		
36 – 50	44 (53.7)	38 (46.3)		
>50	26 (61.9)	16 (38.1)		
Marital status				
Married	66 (56.9)	50 (43.1)	0.188	0.665
Single	16 (61.5)	10 (38.5)		
Church service attendance				
No	28 (34.1)	24 (65.9)	0.512	0.474
Yes	54 (60)	36 (40)		
Social roles / positions				
No	52 (65.0)	28 (35.0)	3.951	0.047
Yes	30 (46.9)	32 (53.1)		
Professions				
Medical officer (MO) / Health extension officer (HEO)	6 (60.0)	4 (40.0)	#1.037	0.636
Nursing officer	28 (63.6)	16 (36.4)		
Community health worker (CHW)	48 (54.5)	40 (45.5)		
Work experience in years				
<10	14 (66.7)	7 (33.3)	11.341	0.003
10 – 20	32 (76.2)	10 (23.8)		
>20	36 (45.6)	43 (54.4)		
Income (salary) per fortnight				
Below 166.67 USD	14 (53.8)	12 (46.2)	0.446	0.800
166.67 – 333.33 USD	40 (60.6)	26 (39.4)		
Above 333.33 USD	28 (56.0)	22 (44.0)		

Note: #Fisher exact test

clinical practice and responsiveness, 70.0% and 56.3% respectively. With perceptions, majority had high perceived susceptibility (61.0%), high perceived severity (56.0%) and high perceived benefits (60.0%). Majority had low perceived barriers (59.2%) and low self-efficacy (60.0%). Regarding cues, more than half (59.2%) were exposed to favourable cues. With practice, close to 60.0% had a poor overall compliance to national guidelines.

Table 1 outlines bivariate analysis of sociodemographic, economic and knowledge level of the participants. Sex, social roles and work experience were statistically associated with overall practice. Descriptive data in terms frequency and percentage can be extracted from the same.

Table 2 outlines bivariate analysis of individual characteristics and exposure to cues. Knowledge, attitude to responsiveness, perceived severity, perceived benefit, perceived self-efficacy and cues to practice were statistically associated with overall practice. Descriptive data in terms frequency and percentage can be extracted from the same.

In order to predict the actual likelihood of factors influencing practice multivariate analysis using as explained in methodology. Variables which had *p*-values less than 0.2 in bivariate analysis in the current study, or those variables

Table 2. Bivariate analysis of knowledge, attitude, perception and cues of health workers with overall practice (n = 142)

Factors	Poor practice n (%)	Good practice n (%)	X^2	*p*-value
Knowledge				
Low	60 (66.7)	30 (33.3)	11.877	0.003
Moderate	12 (33.3)	24 (66.7)		
High	10 (62.5)	6 (37.5)		
Attitudes towards clinical practice				
Negative	16 (61.5)	10 (38.5)	2.681	0.262
Neutral	54 (54.0)	46 (46.0)		
Positive	12 (66.7)	4 (33.3)		
Attitude to responsiveness				
Negative	24 (75.0)	8 (25.0)	8.325	0.016
Neutral	38 (47.5)	42 (52.5)		
Positive	20 (66.7)	10 (33.3)		
Perceived susceptibility				
Low	54 (58.7)	38 (41.3)	0.096	0.756
High	28 (56.0)	22 (44.0)		
Perceived severity				
Low	28 (45.2)	34 (54.8)	7.144	0.008
High	54 (67.5)	26 (32.5)		
Perceived barrier				
Low	46 (54.8)	38 (45.2)	0.751	0.386
High	36 (62.1)	22 (37.9)		
Perceived benefits				
Low	40 (46.5)	46 (53.5)	11.281	0.001
High	42 (75.0)	14 (25.0)		
Perceived self-efficacy				
Low	58 (64.4)	32 (35.6)	4.519	0.034
High	24 (46.2)	28 (53.8)		
Cues to practice				
Favourable	40 (69.0)	18 (31.0)	5.058	0.025
Unfavourable	42 (50.0)	42 (50.0)		

Note: #Fisher exact test

Table 3. Factors associated with overall practice after multivariate analysis

Variables	B	Sig.	AOR	95% CI	
				Lower	Upper
Social roles[(b)]	-0.490	0.416	0.613	0.188	1.994
Profession					
MO/HEO[(R)]		0.637			
Nursing officer	-0.215	0.752	0.806	0.212	3.062
CHW	-0.361	0.348	0.697	0.328	1.481
Work experience in years					
<10[(R)]		0.085			
10 – 20	-2.785	0.521	0.062	0.000	303.395
>20	-1.712	0.029	0.181	0.039	0.836
Knowledge					
Low[(R)]		0.001			
Moderate	0.246	0.815	1.279	0.164	9.966
High	3.750	0.001	42.531	4.239	426.739
Clinical attitude					
Negative[(R)]		0.197			
Neutral	-0.554	0.666	0.575	0.046	7.119
Positive	0.755	0.498	2.128	0.240	18.869

(continued)

Table 3. (continued)

Variables	B	Sig.	AOR	95% CI	
				Lower	Upper
Responsiveness attitude					
Negative(R)					
Neutral	-0.693	0.483	0.500	0.072	3.465
Positive	1.637	0.069	5.141	0.881	29.991
Perceived susceptibility(c)	-1.113	0.081	0.328	0.094	1.147
Perceived severity(d)	1.204	0.091	3.335	0.826	13.454
Perceived barrier(e)	1.450	0.059	4.263	0.945	19.232
Perceived benefits(f)	1.833	0.015	6.251	1.422	27.472
Perceived self-efficacy(g)	-1.457	0.095	0.233	0.042	1.288
Cues to practice(h)	-0.515	0.445	0.597	0.159	2.241

Note: (R): Reference group; a): Male is the reference; b): No social role is the reference;
c): Low perceived susceptibility is reference; d): Low perceived severity is reference;
e): Low perceived barrier is reference; f): Low perceived benefits is reference;
g): Low perceived self-efficacy is reference; h): Favourable cues is reference

Table 4. Factors associated with diagnostic practice after multivariate analysis

Variables	B	Sig.	AOR	95% CI	
				Lower	Upper
Sex(a)	0.470	0.272	1.601	0.691	3.705
Age group in years					
20 – 35(R)		0.002			
36 – 50	-0.892	0.261	0.410	0.086	1.944
>50	-1.773	0.001	0.170	0.062	0.463
Marital status(b)	-0.629	0.200	0.533	0.204	1.396
Profession					
MO/HEO(R)		0.993			
Nursing officer	-21.878	0.999	0.000	0.000	0.000
CHW	0.052	0.908	0.831	1.054	0.433
Knowledge					
Low(R)		0.082			
Moderate	-1.367	0.026	0.255	0.076	0.360
High	-1.099	0.099	0.333	0.090	1.231
Perceived self-efficacy(c)	0.500	0.340	1.643	0.591	4.605
Cues to practice(d)	-0.817	0.080	0.442	0.177	1.102

Note: (R): Reference group; a): Male is reference; b): Married is reference
c): Low perceived self-efficacy is reference. d): Favourable cues is reference

Table 5. Factors associated with treatment practice after multivariate analysis

Variables	B	Sig.	AOR	95% CI	
				Lower	Upper
Sex(a)	0.824	0.046	2.281	1.017	5.117
Marital status(b)	0.748	0.093	2.112	0.884	5.048
Social roles(c)	-0.330	0.453	0.719	0.304	1.702
Work experience					
<10(R)		0.436			
10 – 20	-0.339	0.596	0.713	0.204	2.491
>20	-0.594	0.200	0.552	0.222	1.370

(continued)

Table 5. (continued)

Variables	B	Sig.	AOR	95% CI	
				Lower	Upper
Income					
<K500[R]		0.020			
K500 – K1000	-1.245	0.034	0.288	0.091	0.908
>K1000	-1.241	0.007	0.289	0.116	0.717
Knowledge					
Low[R]		0.111			
Moderate	-0.052	0.941	0.950	0.239	3.772
High	0.974	0.204	2.649	0.588	11.931
Perceived benefits[d]	**0.927**	**0.042**	**2.527**	**1.032**	**6.187**
Perceived self-efficacy[e]	-0.217	0.636	0.805	0.327	1.980
Cues to practice[f]	-0.357	0.298	0.700	0.357	0

Note: (R): Reference group; a): Male is reference; b): Married is reference
c): No social role is reference; d): Low perceived benefits is reference;
e): Low perceived self-efficacy is reference; f): Favourable cues is reference

which were significant in other studies reviewed (despite having *p*-values more than 0.2 in the current study) were included in the multivariate model.

In logistic regression model, sex, profession, attitudes to clinical practice and perceived benefits did not show statistical association with overall practice (Table 3). Work experience over 20 years was a predictor of participants to be less likely to comply with guidelines with overall practice (p=0.029, AOR = 0.181, 95%CI=0.039-0.836). Participants with high knowledge were 42.5 times more likely to comply with guidelines in their overall practice, as compared to those ones with low knowledge (p=0.001, AOR=42.531, 95%CI=4.239-426.739). High perceived benefits were 6.25 times more likely to predict compliant overall practice compared to low perceived benefits (p=0.015, AOR = 6.251, 95%CI = 1.422-27.472).

Logistic regression was also run for other components of practice described in the study: diagnostic practice, treatment practice and follow up, at 95% CI. Participants in the age group >50 years were less likely (p=0.001, AOR=0.170, 95%CI=0.062-0.463)) to comply with national guidelines in their diagnostic practice as compared to age group 20-35 years (Table 4). Participants with moderate knowledge were 0.25 times less likely to comply with guidelines in diagnostic practice (p=0.026, AOR=0.255, CI=0.076-0.360).

Female participants were 2.3 times more likely to comply with guidelines when treating severe malaria (p=0.046, AOR=2.281, CI=1.017-5.117). High perceived benefit was also associated with treatment practice (p=0.042, AOR=2.527, CI=1.032-6.187). Health workers earning more than K500 were less likely to comply with treatment practice (Table 5).

Participants who were single at the time of survey were 6.3 times more likely to follow up discharged severe malaria patients (p=0.012, AOR=6.325, 95% CI=1.491-26.840). Participants with high knowledge were 17.5 times likely to follow up severe malaria patients (p=0.013, AOR=17.487, 95% CI=1.845-165.677). Participants with positive attitude to responsiveness were 5.8 times likely to do follow up (p=0.017, AOR=5.846, 95% CI=1.370-24.943). Participants exposed to unfavourable cues were 0.15 time less likely to follow up patients discharged severe malaria patients (p=0.005, AOR=0.153, 95% CI=0.041-0.575). Nursing officers were 0.159 times less likely to follow up discharged severe malaria patients (p=0.039, AOR=0.159, 95% CI=0.028-0.910), Table 6.

Table 6. Factors associated with follow-up after multivariate analysis

Variables	B	Sig.	AOR	95% CI	
				Lower	Upper
Sex[a]	-1.368	0.056	0.255	0.063	1.033
Marital status[b]	1.845	0.012	6.325	1.491	26.840
Church service[c]	-0.546	0.322	0.579	0.196	1.709
Profession					
MO/HEO[R]		0.060			
Nursing officer	-1.837	0.039	0.159	0.028	0.910
CHW	-1.174	0.089	0.309	0.080	1.196
Income					
<K500[R]		0.049			
K500 – K1000	-0.687	0.367	0.503	0.113	2.242
>K1000	-1.157	0.071	1.3179	0.905	11.167
Knowledge					
Low[R]		0.018			
Moderate	0.215	0.804	1.240	0.226	6.818
High	2.861	0.013	17.487	1.845	165.677
Clinical attitude					
Negative[R]		0.105			
Neutral	0.770	0.453	2.160	0.289	16.145
Positive	1.654	0.074	5.226	0.852	32.070
Responsiveness attitude					
Negative[R]		0.058			
Neutral	1.252	0.182	3.497	0.556	21.991
Positive	1.766	0.017	5.846	1.370	24.943
Perceived severity[d]	0.500	0.479	1.679	0.400	7.049
Perceived barrier[e]	-0.259	0.709	0.772	0.198	3.004
Perceived benefits[f]	-0.593	0.384	0.553	0.145	2.102
Perceived self-efficacy[g]	-0.098	0.802	0.907	0.423	1.946
Cues to practice[h]	-1.879	0.005	0.153	0.041	0.575

Note: (R): Reference group; a): Male is reference; b): Married is reference
c): No church service attendance is reference; d): Low perceived severity is reference;
e): Low perceived barrier is reference; f): Low perceived benefits is reference;
g): Low perceived self-efficacy is reference; h): Favourable cues is reference.

Discussion

Participants who were >50 years were less likely to conform to guidelines in their diagnostic practice. This might be due to older health workers leaning towards clinical diagnosis based on experience. Similar finding was observed by a cross-sectional study conducted in Kenya which found that CHWs over the age of 40 years were less likely to display good performance. However, another cross-sectional study by Bello et al. [6] in Nigeria found null association between age (also sex and work experience). These varied findings could imply that the influence of age on diagnostic practice may vary from one place to another depending on multiple factors, such as trainings. Females were more likely to comply to guidelines when administering treatment to severe malaria patients. Two identified cross-sectional studies agree with finding: a study by Chandler et al. [7] in Tanzania, male of the clinician was among the factors associated with not considering antibiotics in malaria-negative patients; another study by Naimoli et al. [8] in Morocco showed that female health workers among the reasons for adherence to national guidelines. This finding could reflect the general characteristic of women generally being more caring than men, as shown by Bateman's evolutionary studies [9]. Less knowledge was associated with less compliance to diagnostic practice and more knowledge was

associated with following up of discharged severe malaria patients. Knowledge about the possible sequelae of severe malaria is likely to enable a health worker to properly establish the diagnosis and ensure the patient is completely well after discharge. Knowledge being associated with practice was also observed by an Indian cross-sectional study by Kathirvel et al. [10] among physicians which showed that knowledge was among the physician-related factors which predicted level of practice. Nursing officers were less likely to follow up discharged patient compared to medical officers and HEOs. Knowledge gap as well as salary discrepancies could play a part in this regard. However, further studies are required to investigate the possible reason(s). A positive attitude to responsiveness was significantly associated with follow up of discharged patients. This is most likely reflective of health workers who approach patients holistically. A cross-sectional study by Sidani et al. [11] showed that physicians who accord patients an holistic care perform better. Only one HBM construct had statistical significance in this study; high perception of benefits from the participants was associated with good overall and treatment practices. This is most likely due to staff motivation as well as to please superiors in hope of the anticipated benefits. Findings from two cross-sectional studies by Wanduru et al. [12] and Chandler et al. [13] can be summarised that prospective benefits being associated with good health worker practice. Favourable cues were statistically associated with follow up of discharged patients. In the study staff trainings, supervision and data feedback had lots to be desired. The overall favourable cues score is most likely related to availability of malaria commodities to give appropriate care to patients. When health workers have what they require, they are encouraged to follow up patients or accord due care. This hypothesis is supported at different by findings from several cross-sectional studies; Salomão et al. [14], Bamiselu et al. [15] and Zurovac et al. [16].

Our study had several limitations. All responses were self-reported. Convenient sampling was used to select participants on interview days. Causation effects could not be established due to the study cross-sectional design.

In conclusion, high knowledge was associated with good overall and treatment practices. High perceived benefits were statistically associated with good practice. Responsiveness was an encouraging finding. All factors identified to be influencing practice are directly or indirectly to do with staff knowledge and morale. Therefore, a lot needs to be done in terms of training and supportive supervision as a matter of urgency, while simultaneously maintaining a constant supply of malaria commodities.

The recommendation for the future study, researcher should use checklists to verify all variables, especially cues to practice.

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References

1. World Health Organisation [WHO]. World Malaria Report 2016. Geneva : WHO; 2017.
2. Hetzel MW, Saweri OPM, Kuadima JJ, Smith I, Ura Y, Tandrapah A, et al. Papua New Guinea malaria indicator survey 2016-2017: Malaria prevention, infection, and treatment. Goroka ; Papua New Guinea Institute Of Medical Research; 2018.

3. Ghani AC, Sutherland CJ, Riley EM, Drakeley CJ, Griffin JT, Gosling RD, et al. Loss of population levels of immunity to malaria as a result of exposure-reducing interventions: consequences for interpretation of disease trends. PLoS One. 2009; 4(2): e4383. doi: 10.1371/journal.pone.0004383

4. Papua New Guinea, Department of Health Health. National malaria treatment protocol. Waigani : Department of Health; 2009.

5. World Health Organisation [WHO]. Guidelines for the treatment of malaria. 3rd ed. Geneva : WHO; 2015.

6. Bello DA, Tagurum YO, Afolaranmi TO, Chirdan OO, Zoakah AI. Knowledge and pattern of malaria case management among primary health-care workers in Jos. J Med Trop. 2013; 15(2): 91-5.

7. Chandler CI, Chonya S, Boniface G, Juma K, Reyburn H, Whitty CJ. The importance of context in malaria diagnosis and treatment decisions - a quantitative analysis of observed clinical encounters in Tanzania. Trop Med Int Health. 2008 Sep; 13(9): 1131-42. doi: 10.1111/j.1365-3156.2008.02118.x

8. Naimoli JF, Rowe AK, Lyaghfouri A, Larbi R, Lamrani LA. Effect of the integrated management of childhood illness strategy on health care quality in Morocco. Int J Qual Health Care. 2006 Apr; 18(2): 134-44. doi: 10.1093/intqhc/mzi097

9. Wade MJ, Shuster SM. Bateman (1948): pioneer in the measurement of sexual selection. Heredity (Edinb). 2010 Dec; 105(6): 507-8. doi: 10.1038/hdy.2010.8

10. Kathirvel S, Tripathy JP, Tun ZM, Patro BK, Singh T, Bhalla A, et al. Physicians' compliance with the National Drug Policy on Malaria in a tertiary teaching hospital, India, from 2010 to 2015: a mixed method study. Trans R Soc Trop Med Hyg. 2017 Feb; 111(2): 62-70. doi: 10.1093/trstmh/trx020

11. Sidani S, Reeves S, Hurlock-Chorostecki C, van Soeren M, Fox M, Collins L. Exploring Differences in Patient-Centered Practices among Healthcare Professionals in Acute Care Settings. Health Commun. 2018 Jun; 33(6): 716-23. doi: 10.1080/10410236.2017.1306476

12. Wanduru P, Tetui M, Tuhebwe D, Ediau M, Okuga M, Nalwadda C, et al. The performance of community health workers in the management of multiple childhood infectious diseases in Lira, northern Uganda - a mixed methods cross-sectional study. Glob Health Action. 2016; 9: 33194. doi: 10.3402/gha.v9.33194

13. Chandler CI, Meta J, Ponzo C, Nasuwa F, Kessy J, Mbakilwa H, et al. The development of effective behaviour change interventions to support the use of malaria rapid diagnostic tests by Tanzanian clinicians. Implement Sci. 2014 Jun; 9: 83. doi: 10.1186/1748-5908-9-83

14. Salomão CA, Sacarlal J, Chilundo B, Gudo ES. Prescription practices for malaria in Mozambique: poor adherence to the national protocols for malaria treatment in 22 public health facilities. Malar J. 2015 Dec; 14: 483. doi: 10.1186/s12936-015-0996-5

15. Bamiselu OF, Ajayi I, Fawole O, Dairo D, Ajumobi O, Oladimeji A, et al. Adherence to malaria diagnosis and treatment guidelines among healthcare workers in Ogun State, Nigeria. BMC Public Health. 2016 Aug; 16(1): 828. doi: 10.1186/s12889-016-3495-x

16. Zurovac D, Githinji S, Memusi D, Kigen S, Machini B, Muturi A, et al. Major improvements in the quality of malaria case-management under the "test and treat" policy in Kenya. PLoS One. 2014; 9(3): e92782-e. doi: 10.1371/journal.pone.0092782

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