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Knowledge of the Implementation of the Malaria Control Program in Four Health Districts in Yaounde, Cameroon

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ABSTRACT

Malaria is one of the oldest diseases of mankind and has been the greatest scourge and killer of all times. It is caused by protozoan parasites from the genus Plasmodium and is transmitted by the bite of a female Anopheles mosquito or by a contaminated needle or transfusion. Malaria continues to be a threat to socioeconomic development in endemic societies in Sub-Saharan Africa and especially Cameroon being Africa in miniature. This was a cross-sectional study which ran from November 2018 to March 2019 with data collected using questionnaires. The study was carried out in Yaounde, the capital of Cameroon. The study the involved government District Hospitals and Health Centres under the Biyem Assi, Cité Verte, Efoulan and Nkolbisson Health Districts in Yaounde making use of their healthcare providers in the training on malaria case management from October 2017. 92 persons were recruited including 42 persons who were trained on malaria case management and 50 who were not trained. With respect to health districts, 20 participants came from Biyem-Assi, 24 from Cite Verte, 20 from Efoulan and 28 from Nkolbisson. These persons involved some of the healthcare providers in the four health districts who were trained on malaria case management in October 2017 and a number of healthcare providers who were not trained but who work in the same health facilities as the trained healthcare providers. We also employed purposive sampling. The results were summarised into three aspects; malaria diagnosis, treatment and prevention. The trained health care providers demonstrated very good knowledge on the species responsible for malaria, the signs associated with simple malaria, route and duration of simple malaria treatment with percentages of 97.62%, 100%, 97.62% and 90.48% respectively. Similarly, health care providers showed good knowledge with the signs and route of severe malaria treatment of 88.1% and 100% respectively. Corresponding good knowledge was seen with their untrained colleagues though with a slightly lesser percentage in each case. There was a significant difference (P=0.22) in knowledge of healthcare providers on malaria prevention between those trained 90% and those not trained 78.57% with respect to ITN distribution campaign. There was also a significant difference in knowledge with respect to 1st (P=0.01) and 2nd (P=0.02) line treatment on malaria as well as in 1st line treatment for the 1st, 2nd and 3rd trimester of pregnancy (P=0.23, 0.05) respectively between trained and untrained healthcare providers. At the end we realised that there was a good level of knowledge of the components of the training program among those who were trained. There was a higher level of knowledge on malaria diagnosis and treatment for those who were trained compared to those who were not trained and not all the practices in malaria case management were carried out as per the national guidelines.

KEYWORDS: *Malaria, Diagnosis, Treatment, Prevention, Health district*

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Introduction and Background

Malaria is one of the oldest diseases of mankind and has been the greatest scourge and killer of all times. Together with tuberculosis and HIV/AIDS they have been named the "Big Three" and constitute the heaviest infectious diseases burden in endemic countries. Malaria is caused by protozoan parasites from the genus *Plasmodium,* discovered in 1880 by Charles Louis Alphonse Laveran, transmitted by the bite of a female *Anopheles* mosquito or by a contaminated needle or transfusion (Shiel, 2018). It continues to be a threat to socioeconomic development in endemic societies in Sub-Saharan Africa and especially Cameroon being Africa in miniature. An estimated 239 million cases of malaria

occurred worldwide in 2010 compared with 217 million cases in 2016 and 219 million cases in 2017. Although there were 20 million fewer cases in 2017 than in 2010 globally, the period 2015 to 2017 registered only a minimal if slightly upward change in trend, suggesting that progress had generally stalled. The WHO African Region still bears the largest burden of malaria morbidity, with 200 million cases (92%) in 2017, followed by the WHO South-East Asia Region (5%) and the WHO Eastern Mediterranean Region (2%). Globally, 3.4% of all estimated cases were caused by *P. vivax*, with 56% of the *vivax* cases being in the WHO South-East Asia Region. *P. vivax* is the predominant parasite in the WHO Region of the Americas (74%), and is responsible for 37% of cases in the WHO South-East Asia Region and 31% in the WHO Eastern Mediterranean Region (World Malaria Report, 2018). The clinical nature of the disease depends strongly on the background of acquired protective immunity, which is a consequence of the pattern and intensity of malaria transmission in the area of residence (Molineaux, 1997).

Between 2010 and 2017, estimated deaths due to malaria globally declined from 607000 to 435000 cases. Estimates of malaria mortality rate (deaths per 100 000 populations at risk) show that, compared with 2010, all regions had recorded reductions by 2017, except the WHO Region of the Americas, mainly due to a rapid increase in malaria in Venezuela. Globally, 266 000 (61%) malaria deaths were estimated to be in children less than 5 years. The WHO African Region accounted for 93% of all deaths in 2017. It also accounted for 88% of the 172 000 cases reported in 2017 relative to 2010 (607,000) (World Malaria Report 2018).

In 2010, WHO recommended that all suspected malaria cases receive confirmatory diagnosis using the rapid diagnostic test (RDT) or microscopy before antimalarial prescription, (WHO, 2015). In 2011, Cameroon adopted these guidelines as national policy. Diagnosis with either microscopy or RDTs is expected to reduce overuse of antimalarial medicines by ensuring that treatment is given only to patients with confirmed malaria infection as opposed to treating all patients with fever (Thiams *et al*., 2011).

Malaria can be classified as uncomplicated or complicated (severe). For uncomplicated malaria, the most common symptoms are fever and chills, headaches, nausea and vomiting, general weakness and body aches. Complicated or severe malaria occurs when malaria affects different body systems. Symptoms are severe anemia (due to destruction of red blood cells), kidney failure, cerebral malaria characterized by seizures, unconsciousness, abnormal behavior, or confusion; cardiovascular collapse and low blood sugar (hypoglycaemia) (in pregnant women after treatment with quinine) (Ballentine, 2019).

WHO recommends the following artemisinin-based combination therapies (ACTs) for uncomplicated malaria treatment: Artemether-Lumefantrine (AL); Artesunate-Amodiaquine (AS-AQ); Artesunate-Mefloquine (AS-MQ); Artesunate-Sulfadoxine-Pyrimethamine (AS-SP) and Dihydroartemisinin-Piperaquine (DHA-PPQ). The different antimalarials recommended in the treatment of severe malaria are injectable artesunate, quinine injectable and injectable artemether. According to the Cameroon National Guidelines for the treatment against malaria, Cameroon adopted 2 ACTs in the treatment of uncomplicated malaria which are AS-AQ as first line treatment and AL as second line treatment. For the treatment of severe malaria, the recommended treatment is injectable artesunate as first line treatment, injectable Quinine as second line treatment and injectable artemether as third line treatment. In Cameroon, malaria in pregnancy is considered severe. Therefore, treatment during the first trimester is done with injectable Quinine. During the second and third trimesters, injectable artesunate is used as first line and injectable Quinine and injectable artemether as second and third line treatment respectively. In spite of all these decisions, there are still a lot of challenges in malaria case management such as the non-respect of the guidelines, lack of information by some prescribers, the continuity of old case management habits.

As part of the Millenniun Development Goals, (MDGs) leaders in malaria endemic countries adopted the Roll Back Malaria (RBM) framework and MDG was later transformed into Sustainable Development Goals (SDG).

Wide-scale malaria interventions have led to major reductions in overall malaria mortality and morbidity. At the beginning of 2016, an estimated 3.2 billion people in 91 countries and territories (WHO, 2016) were at risk of infection with *Plasmodium*. As part and parcel of SDG, malaria has been recently targeted for elimination by 2030 by adoption of the Global Technical Strategy (GTS) for malaria2016-2030 framework which embraces three pillars; and two supporting elements, with one of the supporting element being harnessing innovation and expanding research, (WHO, 2017). The first pillar of GTS 2016-2030 focuses on ensuring universal access to malaria `prevention, diagnosis and treatment. To this effect there is need of continuous operational research to evaluate and scale up the knowledge of the implementation by health care providers and National Malaria Control Program (NMCP). This paper focuses on the evaluation of health care providers' knowledge on implementation of malaria control program in four Health Districts of the Centre Region of Cameroon; following training sessions by Cameroon's NMCP.

METHODS

It was a cross-sectional study which ran from November 2018 to March 2019 with data collected using questionnaires. Participants gave the most valid answer to each question asked in the questionnaires. The study was carried out in Yaounde, the capital of the Centre Region of Cameroon and the capital city of the country. It is located on latitude 3.87 and longitude 11.52. It has a surface area of 180 km^2 and lies at an elevation of about 750 metres above sea level and has a population of about 2.5 million people. The study involved government District Hospitals and Health Centres under the Biyem-Assi, Cité-Verte, Efoulan and Nkolbisson Health Districts in Yaounde who had healthcare providers involved in the training on malaria case management in October 2017.

TheBiyem-Assi Health District is made up of 11 health areas and a total of 159 health facilities spread throughout these health areas. It has about 80 medical doctors and about 570 other health care providers made up of nurses and others.

The Cite-Verte Health District is made up of 11 health areas and a total of 39 health facilities spread throughout these health areas

The Efoulan Health Districtis made up of 9 health areas and a total of 101 health facilities and has a total number of 120

medical doctors, 500 nurses and 169 medical laboratory technicians.

The Nkolbisson Health District is made up of 7 health areas and a total of 62 health facilities and has a total of 16 medical doctors, 71 nurses, community health workers which are made up of 51 mobilisers and 37 community relay workers.

For the study, 92 persons were recruited including 42 persons who were trained on malaria case management and 50 who were not trained. With respect to health districts, 20 participants came from Biyem-Assi, 24 from Cite Verte, 20 from Efoulan and 28 from Nkolbisson. These persons involved some of the healthcare providers in the four health districts who were trained on malaria case management in October 2017 and a number of healthcare providers who were not trained but who work in the same health facilities as the trained healthcare providers.

The sampling method used was purposive sampling whereby the participants; doctors, nurses and laboratory technicians in the four health districts who were trained or not trained were selected based on their availability and based on whether they gave their consent.

Since 119 healthcare providers were trained in the four health districts. Depending on the available number, these healthcare providers were interviewed and an equal number of other healthcare providers in the same health facilities who were not part of the training were also interviewed giving the total number of healthcare providers for the study but taking into consideration the inclusion and exclusion criteria, as not all health providers who were trained could be found due to different reasons such as transfer and retirement. As such 92 healthcare providers were interviewed; 42 trained and 50 not trained with some districts having more respondents than others depending on their availability. Of these, 7 were medical doctors, 64 were nurses and 12 were medical laboratory technicians

Inclusion and exclusion Criteria

The inclusion criteria for the study involved;

1. Healthcare providers (medical doctors, nurses and lab technicians) in the four health districts who were trained and who worked currently in their health areas or in other health areas within the four health districts.
2. An equal number of healthcare providers who did not take part in the training but also worked in the same health areas as their trained colleagues

The exclusion criteria for the study involved;

1. Any healthcare provider who was trained in one of the four health districts but had been transferred out of the four health districts.
2. Any healthcare provider who was trained in one of the four health districts but had been transferred to an administrative position and thus is not involved in drug prescription.

A questionnaire was developed, and copies made for the healthcare providers involved in the study. Using the list of healthcare providers who took part in the training, each of the hospitals in which they work was visited and a copy of a questionnaire handed to each one of them together with the consent form depending on their availability. In the same hospital, for each trained healthcare provider interviewed, another healthcare provider of the same gender, age and same qualifications as trained colleague who did not participate in the training was interviewed using the questionnaire. The number of questionnaires answered per district were 20 in Biyem-Assi, 24 in Cite Verte, 20 in Efoulan and 28 in Nkolbisson.

The data was entered into Microsoft Excel 2013 was analysed using randomisation techniques at confidence interval of 95%. Descriptive statistics was used to summarise the demographic characteristics while inferential statistics (both the t-test and chi square analysis) was used to analyse the research questions. The results were represented on pie charts and tables.

For ethical and administrative procedures, authorisation was gotten from the Regional Delegation through the Regional Coordinator for malaria of the Centre Region autorisation was also obtaind from the chief medical officer of the public health unit of the Central Region and the acceptance letter was taken to the District Medical Officers of the various districts, the consent of the participants was sought and those who accepted were recruited.

Results

Participants' knowlegde on species, signs and symptoms; and treatment options.

The key results of this study could be summarised into three aspects which are; malaria diagnosis, treatment and prevention. The trained health care providers demonstrated very good knowledge on the species responsible for malaria, the signs associated with simple malaria, route and duration of simple malaria treatment as shown in table 1 with percentages of 97.62%, 100%, 97.62% and 90.48% respectively. Similarly, health care providers showed good knowledge with the signs and route of severe malaria treatment of 88.1% and 100% respectively. Corresponding good knowledge was seen with their untrained colleagues though with a slightly lesser percentage in each case.

Table 1: Participants' knowledge on species, signs and symptoms; and treatment options

Variable	Response in questionnaire	Trained Freq (%)	Not trained Freq (%)	P value
Species for severe malaria	Correct :	41 (97.62)	43 (86)	1.00
Signs associated with simple malaria	Correct	42 (100)	48 (96)	1.00
Route for simple malaria	Correct	41 (97.62)	47 (94)	0.33
Duration of simple malaria treatment	Correct	38 (90.48)	47 (94)	0.85
Signs of severe malaria	Correct	37 (88.1)	41 (82)	0.30
Route for severe malaria	Correct	42 (100)	50 (100)	/
Subsidising antimalarial drugs in children	Correct	35 (83.33)	43 (86)	0.95

Knowledge of malaria prevention

There was a significant difference (P=0.22) in knowledge of healthcare providers on malaria prevention between those trained 90% and those not trained 78.57% with respect to ITN distribution campaign. There was an unusually higher percentage in

knowledge of untrained healthcare provision towards free ITNs distribution to pregnant women (94%) than trained healthcare providers (92.86%). Furthermore, trained healthcare providers were shown to have greater capacity building 66.67% to fight against malaria than untrained personels 60.0%. This is shown in table 2

Table 2: Knowledge of malaria prevention

Variable	Response in questionnaire	Trained Freq (%)	Not trained Freq (%)	P value
Providing free ITNs to pregnant women	Correct	39 (92.86)	47 (94)	1.00
Providing free IPTp to pregnant women	Correct	40 (95.24)	45 (90)	0.59
ITNs distribution campaigns	Correct	33 (78.57)	45 (90)	0.22
Capacity building of actors in the fight against malaria	Correct	28 (66.67)	30 (60)	0.66

Knowledge on treatment options and in pregnancy

There was a significant difference in knowledge with respect to 1st (P=0.01) and 2nd (P=0.02) line treatment on malaria as well as in 1st line treatment for the 1st, 2nd and 3rd trimester of pregnancy (P=0.23, 0.05) respectively between trained and untrained healthcare providers. The relationship in knowledge between trained and untrained healthcare providers was statistically insignificant with respect to 1st and 2ndline treatment of severe malaria as well as recommended antenatal visit to hospital (P=0.86). This is summarized in table 3.

Table 3: Knowledge on treatment options and in pregnancy

Variable	Response in questionnaire	Trained Freq (%)	Not trained Freq (%)	P value
1st line simple malaria	Correct	26 (61.9)	18 (36)	0.01
2nd line simple malaria	Correct	30 (71.43)	21 (42)	0.02
1st line severe malaria	Correct	28 (66.67)	33 (66)	1.00
2nd line severe malaria	Correct	15 (35.71)	19 (38)	0.95
Recommended antenatal visits	Correct	34 (80.95)	38 (76)	0.86
Treatment 1st line 1st trimester	Correct	26 (61.9)	23 (46)	0.23
1st line 2nd and 3rd trimester	Correct	24 (57.14)	21 (42)	0.50

Trained healthcare providers were shown to have increased knowledge 95.24% on malaria diagnosis than untrained healthcare providers66%. Health providers from the different health districts conducted both clinical and laboratory diagnosis for malaria though most of the malaria cases (45) were confirmed from laboratory diagnosis than from clinical diagnosis (1). This is summarized in table 4.

Table 4: Knowledge on malaria diagnosis

Variable	Response in questionnaire	Trained Freq (%)	Not trained Freq (%)	P value
RDT interpretation	Correct	40 (95.24)	33 (66)	0.03

Confirmation of malaria diagnosis	Clinical signs	Laboratory tests	Both
Biyem-Assi	0	9	9
Cite Verte	0	9	15
Efoulan	1	12	4
Nkolbisson	0	15	11
Total	1	45	39 (42.39%)
Test to confirm malaria diagnosis	**Correct**		
Biyem Assi	5		
Cite Verte	4		
Efoulan	8		

DISCUSSION AND CONCLUSIONS

This paper focuses on the evaluation of health care providers' knowledge on implementation of malaria control in four Health Districts of the Centre Region of Cameroon, namely Biyem-Assi, Cite-Verte, Effoulan and Nkolbisson. Few trained malaria healthcare providers were aware of some of the malaria program activities such as the regular capacity building actors in the fight against malaria at all levels of the health pyramid 28 (66.67%), P=0.66 and seasonal malaria chemoprevention in children below 5 in the North and Far North Regions 11 (26.19%), P=0.70. This can be compared to a similar study carried out in Nigeria on operational research by IkeOluwapo *et al* (2017), where most of the participants were not aware of any existing framework that guides malaria operational research (MOR), but a third mentioned affirmatively that there was no existing framework that guides MOR while ten others didn't comment. This lack of knowledge in the healthcare providers could be explained by the fact that the capacity building might not be very effective and the chemoprevention was carried out in the North and Far North regions of Cameroon while this study was carried out in the centre region.

In identifying what lab test was used for confirming malaria diagnosis, Efoulan among the four health districts had the highest number of respondents 8 (40%) who gave the correct responses by performing RDT and the least correct responses came from Nkolbisson, 4 (14.29%). A total of 55 (59.78%) from all the districts choose the incorrect response

(microscopy) which could be used for malaria diagnosis but is not the required method according to the national guidelines. This can be compared to a study in Sudan by Elmardi KA (2009) whereby volunteers were trained on guidelines on the use of RDT for diagnosis. The overall adherence of volunteers to the project protocol in treating and referring cases was accepted but for one of 20 volunteers who did not comply with the study guidelines. Although the use of RDTs seemed to have improved the level of accuracy and trust in the diagnosis, 30% of volunteers did not rely on the negative RDT results when treating fever cases.

The preference for using microscopy could be due to the fact that microscopy is costly compared to the RDTs and the health workers prefer using microscopy which brings in more revenue to the hospital. Furthermore, it could be due to the fact that microscopy had been the standard for a very long period of time and they found it difficult to change from what they already knew. Also, the limited stock of the RDTs could be causing them to use microscopy which is the more available option.

In performing a RDT, health care providers who were trained gave the right responses on how to detect RDT results 40 (95.24%) meanwhile among those who were not trained, 33 (66%) gave right responses (P=0.03) and thus there was a statistically significant difference between both groups. This is similar to a study carried out in Uganda byDaniel J Kyabayinze*et al,* (2012) where 135 health workers were trained including 63 (47%) nursing assistants, a group of care providers without formal medical training. All trainees passed the post-training concordance test with ≥ 80% except 12 that required re-training. Six weeks after the first day of training, 51/64 (80%) of the health workers accurately performed the critical steps in performing the RDT. The performance was similar among the 10 (16%) participants who were peer-trained by their trained colleagues. Only 9 (14%) did not draw the appropriate amount of blood using pipette. The lower percentage in performance among trained participants in our study could be explained by the fact that the study was carried out about a year after the training had taken place which is a much longer period compared to that in Uganda. Also, their trained colleagues may not have explained the RDT process well to them or may not have explained at all.

Among the four districts, it was observed that Cite- Verte had the most respondents 17 (70.83%) who had a pharmacovigilance system in their hospitals while Efoulan had the least respondents 6 (30%). Furthermore, there were a number of respondents 26 (28.26%) who said they had no pharmacovigilance system in their hospitals and 19 (20.65%) who did not even know if there was a pharmacovigilance system or not. This study can be compared to a similar study in India by Dhananjay and Esanakula (2003) where a cross-sectional study was carried out on the knowledge, attitude and practices on 100 medical students geared towards pharmacovigilance. Nearly 87% participants had heard about pharmacovigilance, but only 65% knew its need or purpose. 88% people felt that ADR will increase patient safety.

The smaller percentage of knowledge on the existence of pharmacovigilance in our study could be due to the fact that our health system hasn't made enough emphasis on the presence of a pharmacovigilance system which is a very important aspect in the field of health. This is a pertinent issue as the adverse reactions differ among individuals and could be a basis for the acceptance or refusal of a particular drug.

In the Nkolbisson district all 28 (100%) respondents admitted that pregnant women received ITNs free of charge, while Biyem-Assi had the least respondents 12 (60%). Also, Nkolbisson had the most respondents who admitted that pregnant women received IPTp, 28 (100%) and 26 (92.86%) admitted they received them free of charge while Efoulan had the least respondents 16 (80%) and 15 (75%) respectively. As concerns the number of antenatal visits recommended in pregnancy, 34 (80.95%) respondents who had received training correctly identified 4 visits while 38 (76%) of those who did not participate in the training rightly identified same. There was no statistical significance between the two groups (P=0.86). This can be compared to a survey carried out in Uganda by Kiwuwa Ms and Mufubenga P (2008) among postpartum women who were asked to identify the number of antenatal visits they had, if they received IPTp and ITNs and from the results, of the 88% of pregnant women who had made more than 1 prenatal visit, we noticed that only 31% of them used a bed net during pregnancy and only 36% had received 2 doses of IPTp- SP.

The higher percentages of performance among trained participantsin a particular district in our study could be explained by the fact that the training in the given district was more intense or much more understood and practiced. Futhermore, it could be said that Nkolbisson is a district away from town compared to others and thus could be more conservative and respected the rules better than those closer to the town who could be influenced by malpractices.

In identifying the 1st line treatment of simple malaria, 26 (61.9%) respondents who had received training correctly identified the treatment which is ASAQ while 18 (36%) of those who did not participate in the training rightly identified the same. There was a statistical significance between the two groups (P=0.01) thus we reject the null hypothesis.

Similarly, for the 2nd line treatment of simple malaria, 30 (71.43%) respondents who had received training correctly identified the treatment which is AL while 21 (42%) of those who did not participate in the training rightly identified the same sign and there was also a statistical significance between the two groups (P=0.02). It was observed that the highest district that experienced drug stock out of malaria commodities was Cite Verte 18 (75%) and the least was in Biyem Assi 12 (50%). It is worth noting that of all the malaria medications, RDTs happen to be the mostly out of stock 25 (21.55%) followed by the injectable artesunate 23 (19.83%) while the least was SP 6 (5.17%). The unavailability of this drug can be compared to a study carried out in Timor-Leste by João Soares Martins*et al* (2012) whereby untimely supply of AL and RDTs and the availability of SP prompted the return to former treatment. The lack of respect of guidelines in our study can be explained too by the unavailability of malaria medications. This can be as a result of poor stock management, unavailability of drugs at the level of suppliers as well as the practice of old prescription habits.

Conclusion

1. There was a good level of knowledge of the components of the training program among those who were trained.

2. There was a higher level of knowledge on malaria diagnosis and treatment for those who were trained compared to those who were not trained, while those who were not trained had a higher knowledge on malaria prevention.
3. Not all the practices in malaria case management were carried out as per the national guidelines.

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