Original Research
PRACTICE-BASED RESEARCH

Malaria Perceptions among Medicine Vendors in Buea Community: An Assessment of Knowledge of Malaria and Conditions of Antimalarial Drug Dispensing

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Abstract

***Background**: Lack of knowledge of rational use of antimalarial drugs among medicine vendors is a serious problem, notably in areas of intense transmission. These misunderstandings increase the risks of resistance and adverse drug reactions. This study aimed to assess knowledge of malaria and environments wherein medicine vendors dispense antimalarials in the Buea community.*

***Methods**: Administration of a community-based cross-sectional survey of a random sample of 140 medicine vendors living within the Buea community occurred between March and June 2017. The survey sought to obtain information from medicine vendors on their general knowledge of malaria as well as their dispensing practices. Statistically significant findings were associated with $p \leq .05$.*

***Results**: The majority of participants were aware that use of insecticide – treated bed nets (ITNs) and maintenance of a clean environment equate to effective malaria prevention efforts. Alternatively, only one-third of participants correctly attributed the causative organism of malaria to being protozoan. Participants employed within drugstore settings had less knowledge of malaria than their hospital/community counterparts did. A directly proportional relationship existed between the amount of experience that participants had in their respective disciplines with an increased knowledge of malaria overall.*

***Conclusion**: These findings reveal fluctuating knowledge of malaria among study participants. Reported antimalarial dispensing practices also warrants room for improvement. Routine monitoring and evaluation to prevent emergence of resistant strains to current efficacious antimalarials remains paramount.*

Keywords: antimalarials, drug retail outlets, dispensing, drug resistance, prescription

Background

Malaria remains a leading cause of morbidity and mortality worldwide. The global malaria burden is disproportionately high in Sub-Saharan Africa, which accounts for 90% of malaria cases and 92% of malaria deaths, mostly in children under five years of age.[1] In Cameroon, over 90% of the population is at risk of malaria infection and approximately 41% have at least one episode of the disease each year.[2] Moreover, malaria accounts for 50–56% of morbidity and 40% of the annual mortality in children less than five-years old.[3] Malaria also imposes a heavy economic burden on both individuals and governments, with an estimated direct cost of at least US $12 billion per year.[1]

Significant progress in malaria control has been recorded globally that has resulted in a global decrease in malaria incidence and death rate by 21% and 29% between 2010 and 2015, respectively, in all age groups. An estimated 6.8 million malaria deaths have been avoided globally since 2001.[1] Nevertheless, the emergence and spread of resistance to antimalarial drugs and insecticides, coupled with the lack of a vaccine, have been an impediment to the management of malaria especially in endemic regions.[1] Resistance strains have emerged nearly to all available antimalarials.[1,4] The effectiveness of these antimalarials has increasingly waned including examples such as chloroquine (CQ), a mainstay of 20th century malaria eradication efforts,[4] sulfadoxine-pyrimethamine (SP), an alternative available for large scale implementation for the treatment of uncomplicated malaria,[1] and atemisinin–based combination therapy (ACT), a current first-line treatment for uncomplicated malaria.[1] Resistance is also known to affect all major malaria vector species and all four recommended classes of insecticides. Since 2010, a total of 60 countries have reported resistance to at least one class of insecticide, with a total of 49 of those countries reporting resistance to two or more classes.[5]

This evolution of malaria parasite drug resistance highlights the need to identify and constantly monitor strategies that could extend the therapeutic use of antimalarial drugs. Additionally, there is the need to ascertain and ensure that rational control policies, once adopted, are properly implemented.

Current strategies for managing antimalarial resistance focus on four key elements which include: preventing the emergence of antimalarial drug resistance through rational prescribing and

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dispensing of antimalarials;[4,5] routine monitoring of therapeutic efficacy of first-line and second-line ACTs to detect early changes in P. falciparum susceptibility to antimalarial drugs in endemic countries using in vivo efficacy assays and molecular markers;[5] ensuring a continuous pipeline of new antimalarial medicines with a paradigm shift towards complementary and alternative medicine (medicinal plants); and containing the spread of antimalarial drug resistance once it has emerged.[6] Therefore, strategies to elicit feedback from citizens residing in areas impacted by malaria, along with those directly involved in the dispensing of antimalarials seem prudent. Particularly, a heightened focus on perceptions of malaria's etiology, methods of acquisition and mechanisms for its prevention, in addition to antimalarial prescribing parameters, is apt to inform prevailing rationales for rapid spread of resistant strains especially in endemic regions.[7]

Antimalarial drug resistance emerges due primarily to patient and health system noncompliance to practices regarding malaria treatment policy including irrational prescribing and dispensing of antimalarials, misdiagnosis, incorrect dosing, non-adherence to antimalarial treatment and poor drug quality.[7-10] The above phenomena have increasingly been observed among medicine vendors. Several studies have reported high proportions of presumptive treatment for malaria especially in unauthorized medicine vendors.[11] These tendencies have the potential to facilitate resistance by greatly increasing the number of people who are treated unnecessarily but will still be exerting selective pressure on the circulating parasite population.[11,12]

It has further been reported that some medicine vendors lack knowledge of prescribing restrictions applied to antimalarial medicines.[13] This study aimed to assess medicine vendors in the Buea health district knowledge of etiology, transmission, clinical presentations, and prevention of malaria, in conjunction with their understanding of conditions for antimalarial drug dispensing in Cameroon.

Methodology

This study was conducted in the Buea Health District (BHD) in the South West Region of Cameroon. BHD has an estimated human population of 147,842 inhabitants distributed over 67 communities.[10] Indigenes of the district are of the Bakweri tribe and part of the Bantu ethnic group.[14] Buea has a Cameroon- type equatorial climate characterized by fairly constant temperatures ranging from 18°C-29°C with average humidity of 80% and two seasons: a short dry season (November–March) and a long rainy season (March-November). Malaria transmission occurs all year round with two peak periods, the first in April and May and the second in October and November.[15] The prevalence of malaria parasitaemia in the low-altitude areas ranges from 30% in the dry season to 84% in the rainy season.[16] P. falciparum is the main species accounting for up to 96% of malaria infections in the area while Anopheles gambiae is dominant (most aggressive and most active of the three malaria vectors An. gambiae, An. funestus and Anopheles nili), accounting for up to 72.7% of transmission infection rates.[17] Entomological Inoculation Rate (EIR) to An. gambiae are as high as 287 infective bites/ person/year and 3.93 infective bites/person/night.[18] The study conducted from March to June 2017 was a community-based cross-sectional survey of medicine vendors who reportedly have been selling medications in the health area for at least two years. The sample size was calculated using a standard formula for prevalence studies.[19]

$$n = \frac{Z\alpha^2 pq}{d^2}$$

Where n = sample size, Zα = standard normal deviate, set at 1.96 (for 95% CI), p = the estimate of target population who dispense medication in the district (10%) and at 95% confidence interval and d is a 5% relative precision. A 10% adjustment for non-responses and invalid responses was added.

Prior to data collection, a semi-structured questionnaire was developed and pre-tested for validity. The questionnaire was designed to obtain information from medicine vendors on knowledge of malaria prevention and acquisition along with prescriptive authorities for dispensing antimalarial medications. The first part of the questionnaire contained demographics including gender, age (in years), professional qualifications, dispensary type, and experience (in years). The second part was structured to capture information regarding knowledge about malaria etiology, transmission, signs and symptoms and prevention. For this component of the questionnaire, a "Select All that Apply" format was employed. Practices regarding dispensing of antimalarial medications were assessed using questions about conditions for antimalarials dispensing and knowledge of who is qualified to prescribe antimalarial medications. In addition to the researcher, two research assistants were recruited and trained to administer the structured questionnaire.

The research assistants were trained on the tools to be used, purpose of the study and how to approach respondents and obtain consent. Data were collected by face-to-face interviews, with respondents required to meet the qualification of dispensing antimalarial medications for at least two years. Prior to data collection, the purpose of the study was carefully explained to respondents and written informed consent was obtained before questionnaire administration.

Data were double entered in Microsoft Excel and analyzed using SPSS Statistics 20.0 (IBM Corp, Atlanta, GA, USA). Descriptive statistics were carried out to measure percentages, averages, and relative frequencies of the variables. Relationships among the dependent variable, knowledge of malaria, and independent variables, gender, age group (in years), professional qualifications, dispensary type, and experience (in years), were assessed using the Pearson's Chi-Squared ($\chi 2$) test at 95% CI. Statistical level of significance was set at $p \leq .05$. Ethical approval was obtained from the Institutional Review Board of Saint Monica University (No.2017/SMU/IRB/36). Administrative authorizations

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were sought from the South West Regional Delegation of Public Health and the Buea District Health Service (R11/MINSANTE/SWR/RDPH/PS/40/709). Only individuals who volunteered to participate by signing a written informed consent, after adequate sensitization were enrolled.

Results

One hundred and forty respondents aged 17 – 50 years old participated in the study. Table 1 displays the characteristics of the sample. Of note, this cohort contained more than twice as many males than females. The predominate age group featured participants greater than 20 years but less than 30 years old. Professional designations that were in the majority were equally split between those with nursing credentials and participants without a professional diploma. Respondents that were mostly in a drugstore setting, with less than one-half of a decade of professional experience, outnumbered study counterparts in other dispensary types, and with greater years of experience, in an almost two-to-one fashion, respectively.

Table 2 displays knowledge of respondents' awareness of causes, transmission, signs and symptoms, along with prevention strategies of malaria. Mosquitoes were implicated in some capacity by the majority of respondents as being both causative agents and transmission considerations for malaria; the former assertion dubbed as inaccurate, as protozoan was the correct reply; the latter consideration as partially correct, as the desired response was mosquito bite or blood transfusion. Respondents were largely familiar with signs and symptoms in isolation that may constitute malarial diagnoses such as fever, body weakness, vomiting, and headache. However, participants were less likely to select at least three signs and symptoms collectively. A similar trend existed with knowledge of prevention techniques, with more responses garnered for insecticide-treated-bed nets (ITNs) and clean environments individually than their synergistic effects.

Table 3 displays participant demographics with correct knowledge of malaria based upon domains depicted in Table 2. Two of the participant demographics reported to have the highest representation in Table 1 (male and age 20-29) demonstrated the greatest overall knowledge of malarial principles. However, the remaining demographic types, professional qualification, dispensary type, and years of experience yielded percentages of correct knowledge that did not necessarily mirror the majority number of respondents. Specifically, statistically significant differences in percentages of correct knowledge occurred within both professional qualification and years of experience categories ($p < .005$).

Table 4 displays participant feedback regarding conditions for antimalarial drug dispensing. The percentage of respondents identified as having a hospital/community pharmacy designation conveyed a higher level of understanding of the necessity of a prescription for anti-malarial medications by physicians, pharmacists, and nurses than drugstore participants. The hospital/community pharmacy contingent was also less likely to believe that any health worker or any person could perform anti-malarial dispensing in general. These findings translated into a statistically significant difference in good overall dispensing practices between the hospital/community pharmacy and drugstore sectors ($p = .02$).

Respondent's overall knowledge of malaria was deduced from the correct responses provided for the various aspects of malaria (causative agent, mode of transmission, signs and symptoms and methods of prevention) presented on Table 2. A participant with correct responses for at least three, two, or one of the aspects was considered to have an excellent, fair and poor overall knowledge, respectively. Majority [55(39.3%)] of respondents had excellent, while 46(32.9%) and 39(27.9%) had fair and poor overall knowledge of malaria, respectively. Furthermore, participants with excellent and fair knowledge were classified as having an appropriate knowledge of malaria overall. In all, 101(72.1%) of respondents had a good knowledge of malaria while 39(27.9%) had poor knowledge.

Discussion

Global malaria eradication is threatened on an unprecedented scale by rapidly growing resistance of P. falciparum to conventional antimalarial drugs. A contributing factor to this phenomenon is the misuse of these drugs especially in endemic regions. Overuse of these medications coupled with patient noncompliance to treatment can lead to misdiagnoses, inadequate dosing, incomplete courses and indiscriminate drug use as contributing factors to resistance.[9,20] This study showed that >50% of the drug dispensers in Buea Health District were quite knowledgeable about malaria signs and symptoms as well as preventive methods (Table 2). These findings are aligned with other studies in the district[10,21] and other endemic regions such as Southeast Iran, Malaysia and South Africa[22,23] where participants typically have adequate knowledge of the disease owing to their frequent exposure to malaria. The study also revealed poor knowledge on the cause of malaria with majority (62.1%) of respondents attributing the cause of malaria to mosquitoes (Table 2).

Only 33.6% knew that a protozoan was the causative agent of malaria. It is plausible that respondents may have been unclear about the distinction between cause and transmission.

Although the population of participants with accurate knowledge about the cause of malaria reported here is relatively high compared to studies in Cameroon (31.5%), Ethiopia (1.6%) and Tanzania (6%),[10,24] the limited knowledge may be attributed to the fact that control measures emphasize mosquito related problems rather than the parasite. The study also demonstrates that the knowledge of malaria was strongly associated with level of education. This can be explained by the fact that majority of those who have attained at least secondary level of education with professional diplomas might have been taught about malaria in schools and may also be more likely to read and comprehend information on malaria in print media, radio or

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television. Education clearly influences knowledge about modes of malaria transmission, with educated communities having access to multiple sources of information when compared with their less educated counterparts.[21,25,26] Special strategies such as community educators are therefore required to reach out to the under educated members of the study area with information, education and communication messages on malaria control measures such as ITN use, care and maintenance of ITN life span for protection against malaria.[26]

With the exception of professional qualification and years of experience, correct knowledge of malaria among participant demographics was similar (Table 3). As it relates to professional qualifications, the category encompassing "Pharmacist/MD/Pharmacy Assistant" demonstrated completely correct knowledge (100%), being statistically significantly different from the other categories ($p < .005$).

However, with the multiple professional designations housed within this category, it is difficult to pinpoint the prevailing contributor to these statistically significant findings. The low yield of Pharmacist/MD/Pharmacy Assistant participants ($n = 8$) further complicates the interpretation of these results in relationship to the other groups with almost two to five times greater representation, but less knowledge proficiency. There was a statistically significantly higher level of knowledge observed in the portion of the sample with greater than ten years of experience ($p < .005$).

This increased knowledge base in comparison to peer participants appears to be directly proportional to the expertise acquired over time in managing various types of malaria presentations.

In general, both medicine vendors in the hospital/community and drugstore arenas shared consistent beliefs about conditions for antimalarial drug dispensing (Table 4). Some of the uniformity in responses may relate to inconsistent viewpoints on phrases such as "health worker" or "anybody." In light of these possible varying interpretations, coupled with the dichotomous nature of the questions, an ability to confidently confirm or deny appropriate antimalarial dispensing conditions may have been challenging. It is plausible that the hospital/community dispensing settings encountered more patients treated for complex malaria cases than the drugstore-dispensing environment. This would foreseeably necessitate that the hospital/community group of participants remain more in-tuned with clinical developments. Therefore, the statistically significant difference in good overall dispensing practices may have resulted from disparities in the number and nature of encounters with malaria between the two groups ($p = .02$).

There were some noted limitations to our study. Some answer choices to questionnaire items populated in a co-formulated fashion, e.g., hospital/community pharmacy. These depictions limited abilities to confidently associate respondents' selections with their specific intended descriptions.

Moreover, some respondents may have maintained employment in the hospital/community pharmacy and drugstore settings concurrently. While this disposition may have been in the minority, respondents' categorizations along these lines may have been arbitrary.

Terminology such as "Pharmacy Assistant" may not resonate in other pharmacy settings throughout the world. As a result, any information inferred about this subset of the study sample may be of minimal value globally. Differentiation within the nursing continuum, e.g., licensed practical nurse (LPN) or registered nurse (RN) did not occur. This lack of specification may not allow the respective findings to translate as well to the different members of the nursing profession reviewing these results.

Additionally, clarifying dialogues that ostensibly resulted between the research assistants and the study participants could have confounded the findings.

As the research assistants received training on how to approach respondents, questions directed towards them may have led to certain respondents receiving insights unavailable to others. Nonetheless, this research study overall provided vital information about perceptions of medicine vendors' mindsets towards malaria acquisition, prevention, and antimalarial prescribing constraints. The results generated here are prone to assist public health initiatives continue to address accounts of morbidity and mortality attributed to malaria worldwide.

Conclusion

Efforts to elevate awareness about malaria prevention, acquisition, and containment remain in high demand. Effectiveness of antimalarial medications are prone to abate if resistance continues to mount. Customizable community messages to target audiences that inspire a sense of responsibility to become and remain informed about malaria control procedures are paramount. The findings reported here indicate that sustained global progress in this regard is well within reach.

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Table 1
Demographics of respondents (N = 140)

Demographics		Number (n)	Percent (%)
Gender	Male	95	67.9
	Female	45	32.1
Age Group (years)	<20	6	4.3
	20-29	64	45.7
	30-39	56	40
	40-49	14	10
Professional Qualification	Pharmacist/MD/Pharmacy Assistant†	8	5.7
	Nurse	55	39.3
	Other Degrees	22	15.7
	No Professional Diploma	55	39.3
Dispensary Type	Hospital/Community Pharmacy‡	59	42.1
	Drugstore	81	57.9
Experience (years)	<5	87	62.1
	6-10	30	21.4
	>10	23	16.4

†Pharmacist Assistant: Individual that contributes to the overall medication dispensing process in the presence or absence of formalized educational training.

†MD: Medical Doctor

‡Hospital Pharmacy: A pharmacy location that dispenses traditional medications within an inpatient setting.

‡Community Pharmacy: A pharmacy location that dispenses traditional medications within a residential clinic facility.

‡Drugstore: A medicinal market that encompasses sell of traditional and nontraditional medications and holistic remedies.

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Table 2

Respondents' knowledge of malaria cause, transmission, signs/symptom and prevention (N=140) †

Knowledge Factors		Frequency	% Frequency
	Virus	7	5
	Protozoan	**47**	**33.6**
	Bacteria	9	6.4
Causative agent	Mosquito	87	62.1
	Mosquito bite	135	96.4
	Dirty water	18	12.9
	Contact with patient	4	29
	Blood transfusion	8	5.7
Transmission	**Mosquito bite or blood transfusion**	**143**	**>100%**
	Fever	120	85.7
	Body weakness	96	68.6
	Constipation	12	8.6
	Vomiting	66	47.1
	Headache (HA)	94	67.1
	Stomach disorder	12	8.6
Signs and symptoms	**At least three of the following: fever, body weakness, vomiting, HA**	**77**	**55**
	Use of ITNs	112	80
	Avoid dirty water	10	7.1
	Clean environment	110	78.6
	Safe sexual intercourse	41	29.3
Prevention	**‡ITNs &clean environment**	**88**	**62.9**

†Some respondents selected more than one answer. Number of responses exceeded 140-participant total. Bolded answers: Correct responses

‡ITNs: Insecticide – treated bed nets

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Table 3

Demographic factors of participants with correct knowledge of malaria

		Correct Knowledge [n(%)]	Level of Significance	
	Demographics		Chi-Square	P-Value
	Male	68 (71.6)	.47	.83
Gender	Female	33 (73.3)		
	<20	4(66.7)	.79	.84
	20-29	48(75)		
	30-39	40(71.4)		
Age group	40-49	9(64.3)		
	Pharmacist/MD/Pharmacy Assistant†	8(100)	14.69	<.005
	Nurse	42(76.4)		
Professional Qualification	Other Degrees	14(63.6)		
	No Professional Diploma	32(58.2)		
Dispensary Type	Hospital/community Pharmacy‡	47(79.7)	2.87	.09
	Drugstore	54(66.7)		
	<5	47 (54)	11.19	<.005
Experience (years)	5-10	11 (36.7)		
	>10	19 (82.6)		

†Pharmacist Assistant: Individual that contributes to the overall medication dispensing process in the presence or absence of formalized educational training.

†MD: Medical Doctor

‡Hospital Pharmacy: A pharmacy location that dispenses traditional medications within an inpatient setting.

‡Community Pharmacy: A pharmacy location that dispenses traditional medications within a residential clinic facility.

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Table 4

Conditions for antimalarial drug dispensing (N = 139) †

Conditions for dispensing antimalarials	Response	Dispensing Type n (%)		Level of Significance	
		Hospital/community N=58	Drugstore N=81	Chi-square	P-value
Prescription by physician/pharmacist/nurse	Yes	46(79.3)	62(76.5)		
	No	12(20.7)	19(23.5)	.149	.70
Prescription by any health worker	Yes	17(29.3)	27(33.3)		
	No	41(70.7)	54(66.7)	.253	.61
Prescription by anybody‡	Yes	1(1.7)	9(11.1)		
	No	57(98.3)	72(88.9)	4.461	.06
Overall dispensing practices	*1Good	30(51.7)	26(32.1)		
	*2Poor	28(48.3)	55(67.9)	5.411	.02

†One hospital/community pharmacy respondent did not complete this portion of the survey (139/140)

‡Anybody: Any individual, including but not limited to physician, pharmacist, nurse, or any other individual

*1 If conditions for dispensing are exclusively from prescription by physician/nurse/pharmacist

*2 Conditions for dispensing include prescription from any of the following: anybody, any health worker

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