Cost of Inappropriate Prescriptions for Malaria in Ghana

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Abstract

Background

Malaria remains a global public health challenge despite efforts that have significantly reduced its burden. In addition to prevention, effective treatment using the recommended medicines and approaches is essential to further minimize the burden., Yet, inappropriate prescription of anti-malarial medicines remains a challenge. Malaria prescriptions are described as inappropriate when they do not adhere to standard treatment. Inappropriate prescription presents financial and economic burden for an under-resourced health system. This study examined the cost of inappropriate prescriptions for malaria treatment in Ghana.

Methods

This study used retrospective data collected from January to December 2016 in a number of study facilities in three regions of Ghana. Using stratified random sampling technique, folders of 1625 outpatients who had been treated for malaria were selected from 27 sampled facilities including private, public, and mission hospitals in the Upper East, Volta, and Brong Ahafo regions of Ghana. Two physicians independently reviewed patient folders to assess inappropriate prescription for uncomplicated malaria using the standard treatment guidelines. Inappropriate prescriptions were expressed as the percentage of prescriptions for all uncomplicated malaria cases. Economic cost was computed from two sources-cost of medication and personnel cost (time spent in malaria treatment by prescribers and dispensers). Gross salaries of personnel were used to determine total personnel cost. The sum of the medication and personnel costs constituted the total institutional cost. Total and average costs for nationwide cost was calculated using sample estimates and the total number of uncomplicated malaria cases that received inappropriate prescriptions.

Results

The findings show that about 55% of malaria prescriptions were inappropriate during the review period, which translates into a total economic cost of approximately US$10.4 million for the entire country in 2016. The total cost (average cost) of inappropriate prescription for the study sample was estimated at US$2,515.92 (US$2.77). Total (average) medication cost was US$1,088.42 (US$1.20) and personnel cost was US$1,427.50. In addition, patients received an average of two prescriptions per malaria episode. In terms of ownership distribution of inappropriate prescription, non-compliance was highest in public facilities (58.3%), followed by private facilities (57.5%) and for mission facilities (50.7%).

Conclusion

Inappropriate prescription for malaria is a major threat to malaria management in Ghana. It presents huge financial and economic burden to the health system. Training and strict enforcement of prescribers' adherence to the standard treatment guideline is highly recommended.

Background

In Ghana, malaria remains a major cause of morbidity and mortality among the population. Between 2009 and 2016, it reported that malaria contributed between 31% and 44% of outpatient department cases [2, 3, 4, 5, 6]. To date it remains one of the leading health challenges in the country; with an estimated 2.3 million suspected malaria cases needing treatment in first quarter of 2017 alone [7].

The WHO has over the decade encouraged the Test, Treat and Track Policy (T3 Policy) for the management of uncomplicated malaria cases. The T3 policy outlines that febrile patients must be tested for malaria with a rapid diagnostic test kit (RDT) or by microscopy before treatment. Additionally, the policy also encourages the screening of febrile patients for other non-malarial illnesses. The inappropriate use of medicines remains a major global issue facing many health systems [9]. The inappropriate use of antimalarial medicines by clinicians, general medical practitioners and health facilities are mostly common in many developing countries [10]. This is mostly due to the weak health systems, where mechanisms for routine monitoring and supervision of medicine use are not well developed. Such inappropriate prescription not only raises concerns about resistance to antimalarial, but also have cost implications for management of the disease, burdening further financing schemes. Thus, efficiency in the prescription of antimalarial could free up resources for use in control of the disease.

Studies on inappropriate prescriptions for malaria have reported varied proportions of malaria prescriptions inappropriately done, ranging from 12% and 76.4% in Nigeria and Ghana respectively among children [11, 12] to approximately 74% in India [13]. Other studies report 54.7% in Nigeria [14] and 40% in Sudan [15]. Further, Aina [14] and Uzochukwu [16] both in Nigeria report the average economic cost of inappropriately prescribed malaria medicines to be US$1.03 and US$1.70, respectively. While there are several studies reporting inappropriate prescription for malaria, a few studies have reported the economic cost of inappropriate prescription for malaria in Africa [14, 16].

This study thus set out to estimate the institutional costs associated with inappropriate prescription for malaria in Ghana. This study will provide evidence of the economic burden of inappropriate prescription attitude on health systems and how effective implementation and adherence to Standard Treatment Guidelines (STG) will bring about cost savings.

Methods

Study design and aim

This study design was cross sectional, reviewing patient folders at one time point, and using cost-of-illness approach to estimate the value of resources expended on malaria treatments outside the STG,

which could have been saved.

Sampling of facilities and folders

The country was stratified into three ecological zones to ensure a representation of the diversity of the issues across. These were: (1) Northern – Upper East, Upper West and Northern; (2) Central – Brong Ahafo and Ashanti; and (3) Southern – Volta, Eastern, Greater Accra, Central and Western. One region each was selected to represent one zone. Thus, a total of 3 regions were covered. A list of districts within each region was obtained from Centre for Health and Information Management/ Policy Planning, Monitoring, and Evaluation Division of Ghana Health Service (CHIMS/PPME – GHS). Two districts were randomly selected in each region (one rural, one urban). In each district, the different levels and ownership of facilities were considered, namely public, mission and private. A total of 27 facilities were selected for this study (Table 1).

Sample size for patient folders for all regions

This study was designed primarily to estimate the mean cost of inappropriate prescription in health facilities. Assuming that the cost follows the Gaussian distribution, the equation used in estimating the required sample size is given as follows:

$$n = \frac{\sigma^2 \left(Z_{\frac{\alpha}{2}}\right)^2 (1 + f)}{e^2} Designeffect$$

Where $Z_{\frac{\alpha}{2}} = 1.96$ is the standard normal deviation corresponding to 95% significance criterion,

$f = 10.0\%$ is the non-response rate,

e =0.05 is the margin of error and

$\sigma = 0.75$ is the standard deviation of cost from 2015 National Health Insurance Scheme tariff.

Since σ has not been estimated from previous studies in Ghana, we approximated it using

$$\sigma = {}^{r}/_{4}$$

where r is the range of cost from public primary care hospitals (GHS7.20 - 10.20). Assuming a design effect of 1.709, our estimated sample size for the study was 1,625 patients. This sample size was then allocated to regions (first) and facilities based on population of patients proportional to size.

Once the total sample for each facility for the year was estimated, simple random sampling was used to allocate the sample across the months (since malaria OPD attendance was not uniform across months). This was done by first obtaining OPD attendance register for the year 2016. The sampling frame was OPD malaria attendance for the year 2016. Secondly, monthly breakdown of OPD malaria cases for the year 2016 was obtained from the register, and identification number for folders of malaria patients were recorded. Then, the sample for the month was calculated based on the formula:

$$\left(\frac{A}{B}\right)xC$$

Where,

A = malaria cases for month y in each facility

B = total malaria cases for the year 2016 in each facility

C = total sample size calculated for each facility

The calculation was done for all the months (n = 12) in the year 2016. Thirdly, after obtaining the sample size distribution by month for 2016, all the patients' folder numbers for each month were listed and the sample was drawn randomly. The process was repeated for all 12 months of the year 2016.

Inclusion criteria: Patients' folders containing diagnosis of malaria, and explicitly specified as such in the folder.

Exclusion criteria: Patient recorded to have malaria in OPD register, but malaria diagnosis not clearly written or missing in patient's folder.

Data extraction and variables

A data extraction form was used to gather patient prescription information from their folders. Data from the folders were collected by trained research assistants guided by prescribers in each facility. Using the STG for uncomplicated malaria, prescriptions were assessed and classified into inappropriate and appropriate prescriptions. Variables recorded include data on age, sex, diagnosis and the antimalarial medicines prescribed to the patients.

Data analysis

The average number of medicines per encounter was estimated. This was calculated as: Average number of medicines prescribed per encounter (C) = Total number of medicines prescribed (B) / number of encounters surveyed (A). Further analysis of the data provided additional indices such as pattern of

prescription by Standard Treatment Guideline [17] among prescribers, frequency of antimalarial prescriptions by level of facility and prescriptions by therapeutic groups such as antibiotic prescription, analgesic prescription pattern, antimalarial etc. Finally, two physicians, using the STG as the specified criteria, independently assessed all prescription patterns with malaria diagnosis to determine whether the guide was followed. Disagreements were resolved by discussion and, if necessary, a third independent person was involved.

Determination and definition of inappropriate malaria prescriptions

We determined appropriate prescriptions as those based on appropriate examinations to test for malaria, diagnosis and then prescription of ACTs per the recommendations in the STG. If prescription and treatment did not follow this procedure, then the prescription was defined as inappropriate.

Determination of proportion of inappropriate malaria prescriptions

Based on the records samples per facility type, the proportion of inappropriate prescriptions (i.e., not adhering to STG) was estimated from the total sample size and expressed as the percentage of prescriptions for all uncomplicated malaria cases. A national estimate was calculated based on the sample estimates, number of regions, number of districts and number and type of health facilities in the country.

Estimation of cost of inappropriate prescription (Institutional cost)

The institutional cost of inappropriate prescriptions for uncomplicated malaria comprised medication cost and personnel cost. The costs of medications prescribed outside the STG was determined using prices obtained from the Public Procurement Authority of Ghana (PPA) and the market. Total and average costs were calculated. In the case of personnel cost, the average prescribers and dispensers' times were determined from interviews. These average times were then multiplied by the daily gross salaries of prescribers and dispensers to estimate the personnel costs by health facility type. The summation of the medication and personnel costs constituted the total institutional cost of non-adherence to prescriptions for uncomplicated malaria.

Results of all cost were reported in United States dollar using Bank of Ghana annual average interbank exchange rate, 2016 (US$1.00 equivalent to GHS4.3).

Ethical approval

As a programmatic review for the National Malaria Control Programme, permission for data collection was obtained from the Ghana Health Service Headquarters and Christian Health Association of Ghana, Regional and District Directors, and facility heads.

Results

Background characteristics of patients

A total of 1,625 folders of patients diagnosed with malaria were reviewed across the three regions. The analysis revealed that about 62% (n = 1,005) of patients whose folders were reviewed were females. Moreover, about a fifth of the folders were for children < 5 years (22.2%) and 16% were above 50 years. Approximately 73% (n = 1,189) of patients diagnosed with malaria tested positive, 4.5% (n = 73) tested negative while 22.3% (n = 363) were not tested (Table 3).

Prescription patterns (decisions on prescription pattern)

Our analysis revealed that overall, about 44% of malaria prescriptions were appropriately done while 55% were inappropriate. In terms of prescription pattern by prescriber type, we observed that Nurses were the least compliant to the STG, with about six(6) out of every ten(10) malaria prescriptions (61%) given by Nurses being inappropriate (Table 4). Similarly, Medical officers were less compliant with the STG with more than one in every two malaria prescriptions being inappropriate. Physician assistants were the only group among prescribers that recorded less than half of inappropriate prescription (47.6%). Again, our analysis by facility type showed that the inappropriate prescription across all facilities was more half, range from 52.8% to 59.1%. CHPS compounds recorded the highest level of non-compliance to the STG (59.1%) In addition, the facility ownership showed significant non-compliance to the STG, with health facilities owned by government recording 58.3% of inappropriate prescription. This was followed by private health facilities (57.5%) and mission health facilities (50.7%). Further, across all age categories in this study, inappropriate prescriptions were more than 50% except for prescription among children < 5 years (48.9%) (Table 4).

Pattern of ACTs prescribed

Figure 1 shows the proportion of malaria treatment using ACTs as recommended by WHO. The commonest treatment combination was Artemether – lumefantrine (AL), accounting for approximately 4 out of every 5 ACTs prescribed (79.5%), followed by Artesunate- Amodiaquine, AA (16.6%) and Dihydroartemisinin-piperaquine, (DHP) which is about 3.9%.

Number and cost of other medications prescribed by therapeutic categories

Table 5 shows other medications given to patients and their cost. These medications totaled $1,088.42. Majority of this cost was as a result of additional malaria medications other than ACTs ($384.21). Vitamins and mineral combinations formed the majority (33.5%) of other medications given, followed by

additional non-ACT antimalarial (14.7%), antibiotics (12.2%) and haematinics (9.2%). The average cost of these additional medications ranged between US$0.49 and US$3.72 (Table 5).

Table 6 shows the average number of medicines prescribed per malaria episode and this was around 2.2 for all three regions under study. Facilities in Brong Ahafo prescribed the least number of medicines while facilities in the Volta Region prescribed the most. With regard to excess medicines prescribed, again Brong Ahafo prescribed the least while the other two regions prescribed about the same number of excess medicines (i.e. 1.2).

Cost of prescription outside STG

The total cost (average cost) of inappropriate prescription for the study sample was estimated at US$2,515.92 (US$2.77). Total (average) medication cost was estimated at US$1,088.42 (US$1.20) and personnel cost was US$1,427.50. Personnel cost is made up of prescribing cost [US$1,188.67 (US$1.31)] and dispensing cost [US$238.83 (US$0.26)] (Table 7). Medication and Prescriber cost constituted over 80% of the costs (Figure 2).

The regional estimates of the cost of inappropriate prescription was extrapolated to national estimates using total OPD cases for uncomplicated malaria for 2016. The total number of OPD cases for uncomplicated malaria was 6,812,045[1] and given that the percentage of inappropriate prescription was 55.3%, this translates to 3,767,066 cases for which prescriptions were inappropriate. Also, given that the average cost was US$2.77, the total cost of inappropriate prescription at the national level was estimated to be US$10, 425,135.76 (Table 8).

[1] District Health Information Management System

Discussion

The study finds that about 55% of malaria prescriptions did not follow the standard treatment guidelines, translating into approximately 3.7 million malaria prescriptions (in 2016) that did not follow the STG, nationally. The study has estimated the economic cost of inappropriate malaria prescriptions in Ghana to be approximately US$10.4 million.

The finding that 55% of malaria prescriptions in this study inappropriately done is similar to the finding of 54.7% reported in Nigeria [14]; significantly lower than the 73.9% reported in India [13]; and higher than the 40% and 32% reported in Sudan and India respectively [15] and 12% in Nigeria [11]. It is not immediately clear what factors account for the marked differences between the current study's estimate (55%) and those of Mishra et al. [13] and Ishola et al. [11] – i.e., about 74% and 12%, respectively. However, it is important to note that those two studies focused on malaria in children, while the current study focuses on malaria in the general population. Additionally, the current study's finding that the average number of

medicines prescribed per malaria episode was 2.2 is lower than those reported elsewhere in the sub-region i.e., 6.8 by Uzochukwu [16] and 5.4 by Ishola et al. [11], both in Nigeria.

The current study estimates that the average economic cost of inappropriate malaria prescriptions in Ghana was US$2.77, which is relatively higher than US$1.03 [14] and US$1.70 [16] reported in Nigeria. However, the differences in data year and economic context may have contributed to the differences, aside other factors. Again, this study has estimated the economic cost of non-adherence of malaria prescriptions to STG in Ghana to be approximately US$10.4 million for the year 2016. This cost could have translated into savings for the National Health Insurance Scheme (in terms of saved reimbursements), government (in terms of saved staff time, supplies and other overheads), individuals and households (in terms of saved out-of-pocket expenditures), apart from the possible antimalaria resistance that the overuse could contribute to.

The findings of this study are useful to the health sector of Ghana in a number of ways. First, it is important for the NHIA to intensify claims vetting in order to minimize loses accruing to the NHIS/government due to inappropriate malaria prescriptions. Second, the estimates on cost of inappropriate malaria prescriptions provides an indication of the economic burden of inappropriate prescriptions for malaria to the health system indicating where interventions are needed to target prescriber behaviour. There is the need for NMCP and other stakeholders to intensify training programmes targeting all prescribers while engaging them on the STGs, in order to reduce the inappropriate malaria prescriptions.

Policy implications

Following the study findings, the National Malaria Control programme in its bid to reduce drastically inappropriate prescription in Ghana organized case management trainings for both private and public health facilities biennially with behavior change modules incorporated in the training modules. These group trainings are interspersed with on-site training and supportive supervision in the facilities. During these visits, all thematic areas are assessed (consulting room, laboratory, pharmacy) and action plans are developed with facility managers to help track resolution of identified challenges. Annual peer review meetings for facilities at the same level to learn from each other has been started. The programme has also put together a team that follows up quarterly on facilities that report any form of non-compliance to the treatment protocols to help promptly deal with cases of inappropriate prescription. Facilities also use customized approaches to address the issues of inappropriate malaria prescription, including pharmacies instructed not to serve unconfirmed malaria cases with malaria medicines as well as discussion of inappropriate prescription issues in ward rounds and clinical meetings when they come up. Additionally, together with other stakeholders, stock level monitoring across all facilities is being scaled up through the Ghana Integrated Logistics Management and Information System, which is a national logistics management system. This is to help reduce the issues with logistic stock out which could also influence the appropriateness of prescription.

Conclusion

The study has estimated the economic cost of inappropriate malaria prescriptions in Ghana to be approximately US$10.4 million for 2016, providing the economic burden that inappropriate prescribing behavior present to the health system. It is a good background for the National Health Insurance Authority and Ministry of Health to target for cost containment purposes and improved financing. Moreover, inappropriate prescribing is a threat to quality of life of patients and a potential menace for the anti-malarial drug resistance development. It is crucial for the NMCP to sustain interventiosn that followed the study in order to prevent future development of anti-malarial drug resistance.

Abbreviations

CHPS - Community-based Health and Planning Services

IPTp - Intermittent Preventive Treatment in Pregnancy

RDT - Rapid Diagnostic Test

SSA - sub-Saharan Africa

ACT - Artemisinin-based Combined Therapy

MOH - Ministry of Health

CHAG - Christian Health Association of Ghana

LLIN - Long-lasting Insecticide Net

NHIA - National Health Insurance Authority

NHIS - National Health Insurance Scheme

STG - Standard Treatment Guideline

WHO – World Health Organization

IRS - Indoor Residual Spraying

ITN - Insecticide Treated Mosquito Net

SMC - Seasonal Malaria Chemotherapy

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

The datasets analysed during the current study are not publicly available due because there is institutional control but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

GCA, JN, KM, NYP and MA conceived the study. GCA, JN and NYP designed the study and data collection instruments and supervised data collection. SAA, Jacob N, SA, DD contributed to design and undertook data collection. All authors contributed to data analysis. GCA, JN and RO drafted the manuscript. All authors reviewed and approved the final manuscript.

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Tables

Table 1: Number of selected facilities per region

Region (Ecological zone)	District	Facility	Facility ownership
Volta (Southern)	North Tongu	Battor Catholic Hospital	CHAG
		Juapong Health Center	Government
		Fakpoe CHPS	Government
		Merciful Clinic Limited	Private
	Keta Municipal	Keta Municipal Hospital	Government
		Sacred Heart Hospital	CHAG
		Afiadeyingba Health Centre	Government
		WELSPAN Health Limited	Private
		Sasieme CHPS	Government
Upper East (Northern)	Bawku	Bawku Presby Hospital	CHAG
		Vineyard Hospital	Private
		Urban West Health Centre	Government
		Urban East Health Center	Government
		Baribari CHPS	Government
	Kasena Nankana	War Memorial Hospital	Government
		Biu St. Martin Clinic	CHAG
		Kologo Health Centre	Government
		Nayagnia CHPS	Government
Brong Ahafo (Central)	Wenchi	Wenchi Methodist Hospital	CHAG
		Emil Memorial Hospital	Private
		St. Joseph's Catholic Clinic	CHAG
		Wenchi Health Centre	Public/Government
		Amponsakrom CHPS	Public/Government
	Nkoranza South	St. Theresa's Catholic Hospital	CHAG
		Patmos Medical Centre	Private
		Bonsu Health Centre	Public/Government
		Akuropong CHPS	Public/Government

Table 2: Number of folders sampled per facility

Region	District	Facility	Facility ownership	Number of folders
Volta	North Tongu	Battor Catholic Hospital	CHAG	141
		Juapong Health Center	Government	40
		Fakpoe CHPS	Government	30
		Merciful Clinic Limited	Private	30
	Keta Municipal	Keta Municipal Hospital	Government	106
		Sacred Heart Hospital	CHAG	42
		Afiadeyingba Health Centre	Government	74
		WELSPAN Health Limited	Private	30
		Sasieme CHPS	Government	30
Upper East	Bawku	Bawku Presby Hospital	CHAG	142
		Vineyard Hospital	Private	128
		Urban West Health Centre	Government	30
		Urban East Health Center	Government	31
		Baribari CHPS	Government	30
	Kasena Nankana	War Memorial Hospital	Government	96
		Biu St. Martin Clinic	CHAG	45
		Kologo Health Centre	Government	30
		Nayagnia CHPS	Government	30
Brong-Ahafo	Wenchi	Wenchi Methodist Hospital	CHAG	147
		Emil Memorial Hospital	Private	87
		St. Joseph's Catholic Clinic	CHAG	55
		Wenchi Health Centre	Public/Government	50
		Amponsakrom CHPS	Public/Government	30
	Nkoranza South	St. Theresa's Catholic Hospital	CHAG	54
		Patmos Medical Centre	Private	49
		Bonsu Health Centre	Public/Government	38
		Akuropong CHPS	Public/Government	30

Total	**1625**

Table 3: Background characteristics of patients

Age	Upper East	Volta	Brong Ahafo	Total
	n (%)	n (%)	n (%)	n (%)
0-4	123(21.3)	64(12.6)	173(32.0)	360(22.2)
5 - 9	90(15.6)	64(12.6)	97(18.0)	251(15.4)
10 - 19	118(20.4)	94(18.5)	77(14.3)	289(17.8)
20 - 29	72(12.5)	58(11.5)	52(9.6)	182(11.2)
30 - 39	43(7.4)	62(12.2)	31(5.7)	136(8.4)
40 - 49	41(7.1)	65(12.8)	40(7.4)	146(9.0)
50+	91(15.7)	100(19.7)	70(13.0)	261(16.1)
Total	578(100)	507(100.0)	540(100.0)	1625(100)
Sex	n (%)	n (%)	n (%)	n (%)
Female	347(60.0)	336(66.3)	322(59.6)	1005(61.8)
Male	231(40.0)	171(33.7)	218(40.4)	620(38.2)
Total	578(100.0)	507(100.0)	540(100.0)	1625(100.0)
Test Results	n (%)	n (%)	n (%)	n (%)
Positive	555(96.0)	300(59.2)	334(61.9)	1189(73.2)
Negative	14(2.4)	36(7.1)	23(4.3)	73(4.5)
Not Tested	9(1.6)	171(33.7)	183(33.9)	363(22.3)
Total	578(100.0)	507(100.0)	540(100.0)	1625(100.0)

Table 4: General pattern of malaria prescription and selected variables

Description	Appropriate	Inappropriate	Undecided	Total	Chi-square
Malaria Test Result	n(%)	n(%)	n(%)	n(%)	
Positive	694(58.4)	483(40.6)	12(1.0)	1189(100)	**0.000**
Negative	7(9.6)	63(86.3)	3(4.1)	73(100)	
Not tested	9(2.5)	353(97.2)	1(0.3)	363(100)	
Age group					**0.056**
<5	180(50.0)	176(48.9)	4(1.1)	360(100)	
5-12	151(41.8)	208(57.6)	2(0.6)	361(100)	
13-17	66(48.2)	70(51.1)	1(0.7)	137(100)	
18-59	237(40.0)	347(58.5)	9(1.5)	593(100)	
Above 60	76(43.7)	98(56.3)	0(0.0)	174(100)	
Sex					**0.208**
Male	263(42.4)	348(56.1)	9(1.5)	620(100)	
Female	447(44.5)	551(54.8)	7(0.7)	1005(100)	
Facility type					**0.084**
CHPS compound	67(38.1)	104(59.1)	5(2.8)	176(100)	
Health Center	151(46.6)	171(52.8)	2(0.6)	324(100)	
Private Clinic/Hospital	173(43.4)	221(55.4)	5(1.3)	399(100)	
Hospital	319(43.9)	403(55.5)	4(0.6)	726(100)	
Facility Ownership					**0.039**
Mission	292(48.7)	304(50.7)	4(0.7)	600(100)	
Private	148(41.3)	206(57.5)	4(1.1)	358(100)	
Public	270(40.5)	389(58.3)	8(1.2)	667(100)	
Type of prescriber					**0.000**
Medical Officer	433(43.2)	561(56.0)	8(0.8)	1002(100)	
Physician assistant	163(51.4)	151(47.6)	3(0.9)	317(100)	
Nurse (CHN, EN etc)	114(37.3)	187(61.1)	5(1.6)	306(100)	
Total	**710(43.6)**	**899(55.3)**	**16(1.0)**	**1625(100)**	

Table 5: Number and cost of other medications prescribed by therapeutic categories

Therapeutic Group	n (%)	Total Cost US$	Average Cost US$
Analgaesic/Antipyretics	37 (5.3)	37.72	1.02
Antibiotics	85 (12.2)	149.80	1.76
Antidiabetics	14 (2)	52.02	3.72
Antifungal	12 (1.7)	11.80	0.98
Antihelmintics	42 (6)	82.96	1.97
Antihistamines	14 (2)	7.53	0.54
Antihypertensives	21 (3)	44.19	2.10
Additional antimalarial	102 (14.7)	384.21	3.77
Cough expectorant/ Antitussives	19 (2.7)	24.59	1.30
Haematinics	64 (9.2)	70.09	1.10
Vitamin and mineral combinations	233 (33.5)	114.24	0.49
Glucose-Elevating Agents	22 (3.2)	51.16	2.33
Other[1]	31 (4.5)	58.09	1.87
Total	696 (100)	1,088.42	1.56

Table 6: Average number of medicines prescribed per malaria episode

Item	Upper East	Volta	Brong Ahafo	All regions
Average number of medicines prescribed per malaria episode[2]	2.1	2.7	1.8	2.2
Average number of excess medicines prescribed per malaria episode	1.2	1.2	1.1	1.2

Table 7: Cost of inappropriate prescription (i.e. outside STG)

Cost component	Upper East	Volta	Brong Ahafo	Total cost	Average cost
Medication	315.09	590.43	182.90	1,088.42	1.20
Prescribing	344.29	573.51	270.87	1,188.67	1.31
Dispensing	89.15	78.42	71.26	238.83	0.26
Total cost	748.52	1,242.36	525.03	2,515.92	2.77

Table 8: National estimates of cost of non-adherence to STG

National OPD uncomplicated malaria case	Percentage inappropriately prescribed	Estimated national number of cases with inappropriate prescription	Cost per inappropriately prescription per case	Total Cost of inappropriate prescription
6,812,054	55.3	3,767,066	2.77	10,425,135.76

[1] Antacids & Laxatives, Anti-asthmatics, Anticovulsants, Antidepressants, Nonsteroidal Anti-inflammatory Medicines, Proton Pump Inhibitor, Sterile irrigating solutions

Figures

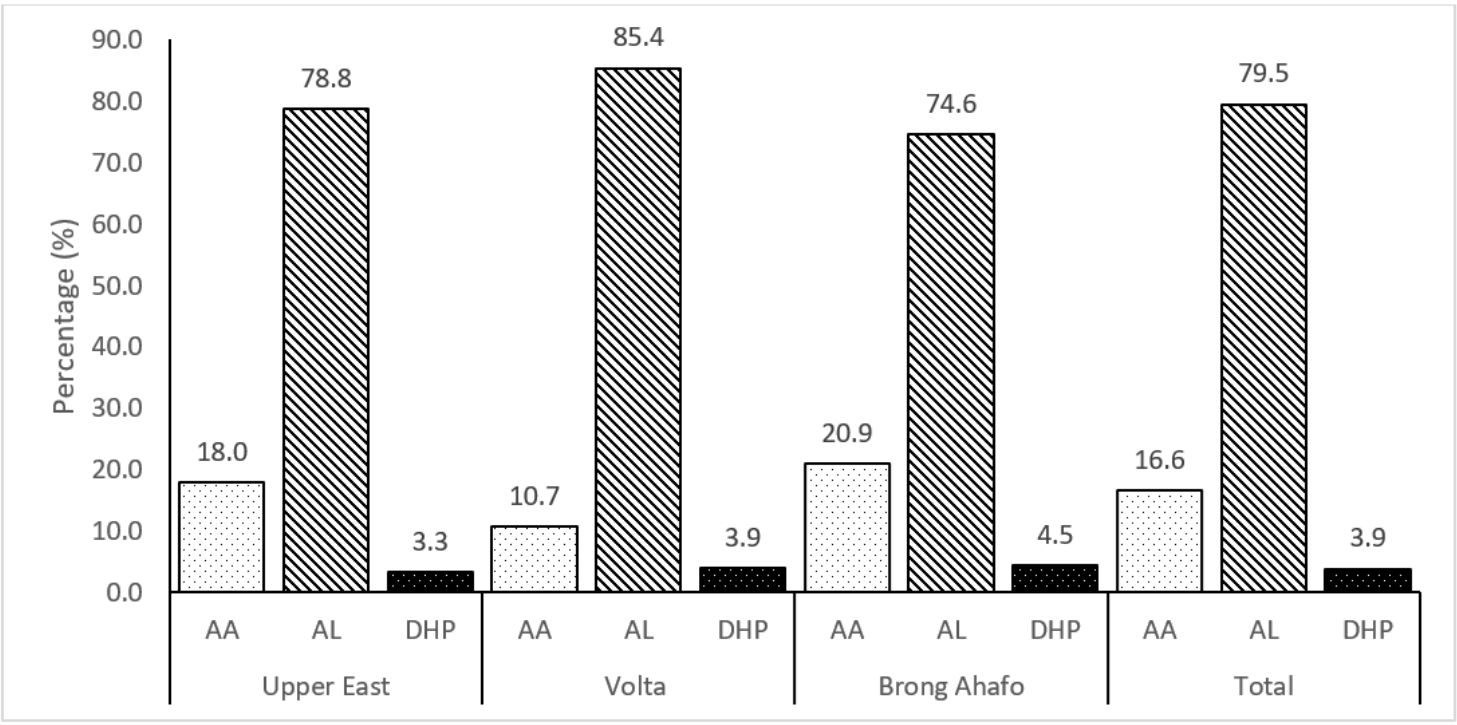

Figure 1

Antimalarial combination treatment

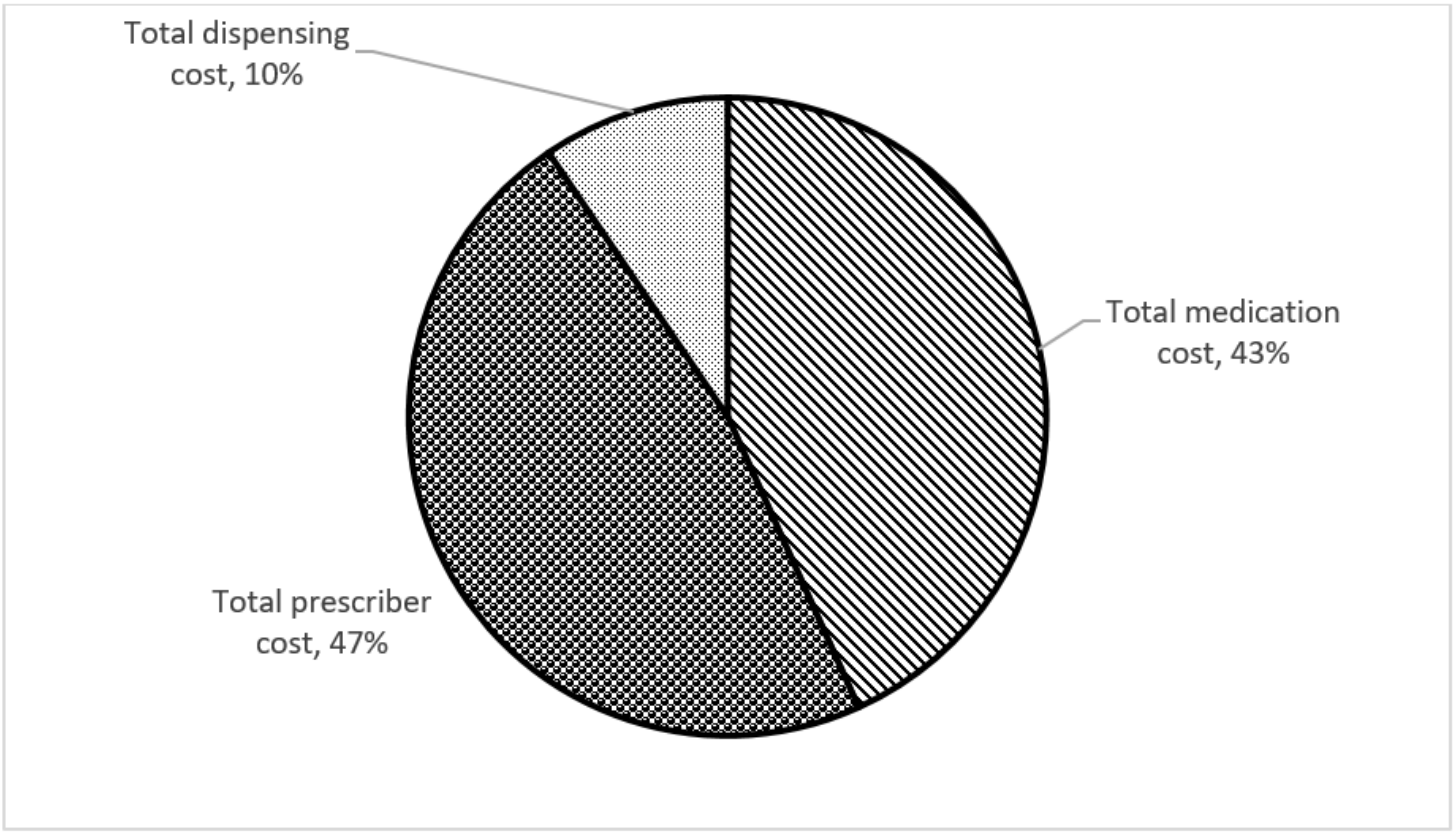

Figure 2

Cost profile for inappropriate prescription