Original Article

Availability and prescription practice of anti-malaria drugs in the private health sector in Yemen

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Abstract

Introduction: Although the government of Yemen changed the national policy for treating malaria in November 2005 from chloroquine to combination drugs in the form of artesunate + sulphadoxine-pyrimethamine (SP) as first line and lumefantrine + artemether as second line treatment for uncomplicated malaria, clinicians in public and private health facilities continued to prescribe chloroquine because their knowledge about the new treatment policy was poor.

Methodology: A non-randomized trial of pre- and post-evaluation of the training and reporting interventions about prescription behaviors and availability of anti-malaria drugs among clinicians and pharmacists in the private sector in three governorates in Yemen was conducted.

Results: Adherence of clinicians in the private sector to the new national guidelines for anti-malaria drugs improved from 21% in pre-intervention period to 38% after the intervention for artesunate + SP being prescribed as the first-line treatment. Prescription of lumefantrine + artemether as the second-line anti-malaria treatment was also improved from 18% before the intervention to 22% post-intervention. Unfortunately the combination of halofantrine + SP continued to be frequently prescribed by clinicians in Sana'a city (18%). Artesunate + SP and quinine are increasing their marketing significantly from 8% in the pre-intervention period to 22% post-intervention (P-value 0.001).

Conclusions: The study provides evidence of usefulness of the training intervention on the national guidelines for malaria treatment. Additionally, the involvement of private health-care providers in reporting procedures will promote the rational prescription and availability of anti-malaria drugs.

Key words: malaria; surveillance; private; Yemen

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Introduction

In response to the rapid evolution of parasite resistance to chloroquine, several countries have modified their national anti-malarial drug policies and adopted the artemisinin derivative combined treatments (ACTs) for malaria therapy as recommended by the World Health Organization (WHO) [1].

In Yemen, chloroquine is no longer recommended by the National Malaria Control Program (NMCP) because the resistance rate was 39% to 57% in four sentinel studies in different epidemiological strata during the years 2002 to 2005, while sulphadoxine-pyrimethamine (SP) was found to be effective (95% to 100%). Based on this information, the national anti-malarial drug policy for Yemen was revised in November 2005 to replace chloroquine with combination drugs in the form of artesunate + sulphadoxine-pyrimethamine(SP) as the first-line treatment and lumefantrine + artemether as the second-line therapy for uncomplicated malaria. In spite of these changes, quinine or artemether injection/artesunate suppository) remained the treatment of choice in severe malaria cases [2].

Earlier reports from other parts of Africa also demonstrated either low or non-adherence of physicians to the changes in malaria treatment policies from chloroquine to ACTs. A study by Manirakiza and colleagues showed that about 93% of health professionals in Bangui in Central African Republic were not following the country's national malaria management policy [3]. In Nigeria, it was reported that only 5.9% of anti-malaria prescriptions from hospitals contained ACTs despite the high proportion of

prescribers who claimed to follow the national anti-malaria policy change from chloroquine to ACTs as the first-line therapy [4], especially in private hospitals [5]. Inappropriate prescription of anti-malaria drugs was also observed in the private sector in Ghana [6].

Adherence of physicians to any new treatment policy is a behavioural issue. People are able to adapt their behaviour when new information is introduced to them, even if a previous behaviour pattern has been established through reinforcement; a theoretical framework involves learning by doing, where a physician can learn how to use a given drug effectively only by prescribing that particular drug to patients [7].

Appropriate prescription behavior is subject to different factors including the training received and specific education of health professionals, as well as the availability of the recommended drugs [8]. Appropriate training and supervision are recommended to improve adherence to any change in treatment guidelines to new regimens [9].

Now there is increasing emphasis on the privatization of the health-care sector in many developing countries by international financial institutions and national governments; they expect an expanding role for private health-care practitioners in the management of major communicable diseases such as malaria [10].

In Yemen, many people seek care in the private sector, which provides mostly curative services, and private practitioners are also a major source of health-care for many people in developing countries. In Yemen, about 75% of all malaria cases were being managed in the private sector, which constitutes the bulk of malaria burden in the country [11]. Therefore, it is important to consider the private sector in any change in malaria case management policies. The availability of ACTs and other anti-malaria drugs in the private sector and prescription practices of anti-malaria drugs among private clinicians has not yet been assessed in Yemen.

The training of health-care providers in the private sector about the national malaria treatment guidelines and monthly reporting of prescription practices of the health-care providers to the malaria control program are expected to promote physician adherence, appropriate prescription, and the co-operation of the private health sector providers with the national malaria control program.

This study aimed to assess the training and reporting interventions for promoting appropriate anti-malaria drug prescriptions and availability in private health-care services in three governorates in Yemen. The study is part of a project that was funded by TDR/EMRO/WHO during the period 2010/2011.

Methodology

Study setting

The study was conducted in three governorates of Yemen: Al Hudidah west of Yemen; meso to hyperendemic), (Hadramout east of Yemen; mostly hypoendemic) and Sana'a city (capital of Yemen, malaria free but where many referral hospitals are located). A total of 11 districts were selected from these three governorates. The capitals of each of the two governorates were chosen because many private facilities are located in the capitals. The second or the third districts were selected based on their being either an endemic region for malaria or a second line of referral from other endemic areas. The remaining six districts were chosen from Sana'a, the capital, where many private facilities are located.

Study design and subjects

We conducted a non-randomized trial of pre- and post-evaluations of the training and reporting interventions regarding prescription behaviours and the availability of anti-malaria drugs among clinicians and pharmacists in private health-care services in three governorates in Yemen. The subjects were clinicians, pharmacists, and drugstore personnel in private health-care institutions (clinics and pharmacies) from the three selected governorates.

Sample size and sampling technique

The study involved 105 facilities, divided into two groups (55 clinics & 50 pharmacies) which constitute about 20% of the private sector in the three selected governorates. From each clinic or pharmacy one clinician, pharmacist, or drugstore technician was selected, resulting in a total of 105 participants comprised of 55 clinicians and 50 pharmacists and/or drug store personnel.

An *ad hoc* screening was implemented for most of the private health-care facilities in the 11 districts. Accordingly, some were selected by simple random selection. A contract form was prepared and signed by both the owner of the public health facility and one member of the study's supervisory team; the objectives of the project and the procedures were clearly explained to all participants.

Interventions

The intervention was comprised of two components: the first was a one-day training course, and the second was the involvement of the participants in reporting their prescription practices following the training.

A one-day training course was conducted in each of the three governorates: one in the Al-Hudadah Malaria Control Program, one in the Hadramout Malaria Control Program, and one in the Sana'a Malaria Control Program. Participants were grouped according to their accessibility to the training sites. In each course, the participants acquired knowledge about the national guidelines for prescribing anti-malaria drugs and the program's reporting mechanism. Managers of the malaria control program in the targeted governorates conducted the training courses according to the training module of the National Malaria Control Program of the Republic of Yemen [12].

Involvement of participants in the reporting mechanism

Two simple reporting forms were created. One form was specific for reporting malaria-related events from private clinics and the other form for reporting anti-malaria drug-related data from the private pharmacies and drugstores. The content of both forms was pre-tested in two facilities for a period of one week and was validated by a peer team of clinicians, pharmacists and managers from the malaria control programs in the targeted governorates; the content was then reformulated accordingly. Each participant received one reporting register containing the reporting forms and was followed monthly through active visits by a trained supervisor in each district. The reporting process was followed over six months from November 2010 to April 2011.

Instruments used

Two instruments were used for every professional category (clinicians and pharmacists). The first was a structured questionnaire for pre- and post-intervention survey and the second form was the reporting registry. The questionnaire was divided into four sections: 1) identification data, 2) epidemiological data, 3) knowledge and attitude, and 4) prescription practices for clinicians and availability and marketing of anti-malaria drugs for pharmacists. Data from only the first and the fourth sections are presented here for the purposes of this paper. At the end of the six-month reporting period, a post-intervention survey was conducted to evaluate the availability, marketing, and prescription practice of anti-malaria drugs in the targeted pharmacies and clinics. The same test questionnaire that was used pre-testing was also used in the post-intervention survey.

Study variables

The following information was recorded for each patient in each clinic's registry: name of patient, date of visit, age, sex, address, diagnosis of malaria (confirmed/clinical), and types of anti-malaria drugs prescribed. In each pharmacy's registry the following information for each patient was recorded: name of patient, age, sex, and types of anti-malaria drugs given.

The structured questionnaire that was used pre- and post-survey contained independent personal variables and outcome variables.

The outcome variables were as follows: 1) prescription of anti-malaria drugs among clinicians of the private sector, measured in terms of number and percentage of each type of anti-malaria drug prescribed by clinicians. This variable was described according to the clinical status of the cases: uncomplicated malaria, severe malaria, or malaria in pregnancy; 2) availability of anti-malaria drugs in the private sector measured in terms of number and percentage of each type of anti-malaria drug available in the targeted pharmacies or drugstores; 3) marketing of anti-malaria drugs in the private sector measured in terms of number and percentage of each type of anti-malaria drug sold from the targeted pharmacies or drugstores.

Statistical analysis

The obtained data were entered and analyzed using SPSS version 11.5 (SPSS, Chicago, USA). Frequency, percentages, means, standard deviations, and ranges were used for univariate analyses. A confidence interval (CI) of 95% and chi square were used for bivariate analyses. Significance level used was 0.05.

Results

Eighty-six out of 105 (82%) clinicians and pharmacists in the private sector agreed to participate in the study. The 86 questionnaires were completed by 37 pharmacists and drugstore personnel and 49 clinicians. Two of the 49 clinicians were lost during follow-up; (one died and the other closed their clinic); therefore, 47 clinicians completed the study. Data from all 49 clinicians were analyzed according to the principle of "intended to treat" in the pre-intervention

analysis. Data of the remaining 47 clinicians were included in the analysis of the post intervention data.

The mean years of experience of the clinicians was 18 ± 6 years, while the mean years of experience of the pharmacists was 9 ± 6.3 years. Most of the participants were males (80/86; 93%). Forty percent (34/86) of the participants worked in the private sector, while the majority of the participants worked in both the private and public sectors. Most of the participants (60/86) had no previous training in malaria treatment (70%).

Anti-malaria drugs and prescribing practice in the pre-intervention period

The pre-intervention survey was conducted one month before the intervention. Although 23% of clinicians in the private sector reported that they prescribed artesunate + SP (ACTs) for treatment of uncomplicated *falciparum* malaria, another 21% still prescribed chloroquine as the drug of choice. Other drugs also prescribed as a first choice were lumefantrine + artemether (21 %) and artemether (17%). Quinine is frequently prescribed for treatment of severe malaria (72%) and artemether injection for treatment of malaria in pregnancy (47%). The availability of anti-malaria drugs in the market reflected the style of prescription by the clinicians. The anti-malaria drugs most available in private pharmacies and drugstores were monotherapy in the form of chloroquine tablets and syrup (81% and 78.7%, respectively), artemether injections and tablets (78% and 73%, respectively), and sulphadoxine-pyrimethamine (SP) tablets (78%). Combination therapy was available in 19% of the studied pharmacies (both for artesunate + SP or lumefantrine + artemether). The most anti-malaria drugs sold from private pharmacies during one month before the study were chloroquine (43%), lumefantrine + artemether (38%) and artemether injections (32%). Only 8% of pharmacies sold artesunate + SP. This figure reflects what had been sold from the available anti-malaria drugs in the market but did not reflect the true need for anti-malaria combination therapy.

Post-intervention evaluation of availability and prescription practice of anti-malaria drugs

Although chloroquine was available in 80% of the studied pharmacies (Table 1), it was the least sold anti-malaria drug in the market and its monthly marketing significantly decreased from 43% one month before the intervention to 11% six months post-intervention (P-value = 0.001) (Table 2). Table 3, however, shows that it was still being prescribed after the intervention by 15% of the clinicians for the treatment of uncomplicated *falciparum* malaria and by 22% of the clinicians for the treatment of malaria in pregnancy (Table 4).

While the availability of artesunate + SP combination therapy increased in private pharmacies from 27% before the intervention to 43% post-intervention, this increase is not statistically significant (P-value = 0.14) (Table 1). Artesunate + SP and quinine increased their marketing significantly from 8% in the pre-intervention period to 22% post-intervention (P-value = 0.001) (Table 2). Artesunate + SP combination was the anti-malaria drug most prescribed by clinicians for the treatment of uncomplicated *falciparum* malaria post-intervention (38%), but the difference is not significant when compared with the pre-intervention period (P-value = 0.09) (Table 3).

Quinine was the anti-malaria drug most prescribed by clinicians for the treatment of severe malaria (72% and 79% pre- and post-intervention periods, respectively) (Table 5). Moreover, quinine prescription for the treatment of malaria in pregnancy improved significantly from 17% in the pre-intervention period to 60% post-intervention (P-value = 0.004) (Table 4).

Lumefantrine + artemether is the second-line anti-malaria combination therapy recommended by the NMCP. The availability of this drug in private pharmacies increased from 19% before the intervention to 35% post-intervention, but this increase is not statistically significant (Table 1). Furthermore, its marketing reduced from 38% pre-intervention to 19% post-intervention (Table 2). Lumefantrine + artemether was prescribed by about 22% of the clinicians for treatment of uncomplicated *falciparum* malaria in both the pre- and post-intervention periods (Table 3).

Artemether is one of the most available anti-malaria drugs in private pharmacies (78% and 81% in the pre- and post-intervention periods, respectively) (Table 3). While its marketing reduced from 32% in the pre-intervention period to 24% in the post-intervention period, this reduction is not statistically significant (P = 0.43) (Table 2). A non-significant reduction was also reported among clinicians for the prescription of artemether for the treatment of uncomplicated *falciparum* malaria, dropping from 17% in the pre-intervention period to 6% in the post-intervention period (P = 0.13) (Table 3), but its

Table 1. Availalbility of anti-malaria drugs in pharmacies and drugstores one month before and after the intervention

Antimalaria drugs	Pre-intervention N = 37	Post-intervention N = 37	OR	CI 95%	P-value
Chloroquine	30 (81%)	30 (81%)	1	NA	NA*
Sulphadoxine-pyrimethamine (SP)	30 (81%)	30 (81%)	1	NA	NA
Quinine	20 (54%)	21 (57%)	1.2	0.40 _ 3	0.81
Mefloquine	6 (16%)	1 (3%)	0.14	0.01 _ 1.4	0.047
Artemether	29 (78%)	30 (81%)	1.2	0.33 _ 4	0.77
Primaquine	12 (32%)	11 (30%)	0.89	0.32 _2.5	0.81
Artesunate + SP	10 (27%)	16 (43%)	2	0.7 _ 6	0.14
Artesunate	7 (19%)	4 (11%)	0.52	0.11 _ 2.2	0.32
Lumefantrine + Artemether	7 (19%)	13 (35%)	2	0.7 _ 7	0.11
Halofantrine	16 (43%)	12 (32%)	0.63	0.2 _ 2	0.33
Others**	3 (8%)	0	0	0 _ 2.2	0.07

*Not Applicable
**Others: artesunate (Plasmotrim), artesunate suppository

Table 2. Pre- and post-intervention evaluation of types of anti-malaria drugs sold from 37 private pharmacies

Antimalaria drugs	Pre-intervention	Post-intervention	OR	CI 95%	P-value
Chloroquine	16 (43%)	4 (11%)	0.16	0.04 _ 0.61	0.001*
Lumefantrine + Artemether	14 (38%)	7 (19%)	0.38	0.12 _ 1.23	0.07
Artemether	12 (32%)	9 (24%)	0.67	0.21 _2	0.43
Sulphadoxine-pyrimethamine (SP)	5 (13.5%)	6 (16%)	1.2	0.29 _ 5	0.74
Quinine injection	3 (8%)	8 (22%)	5.3	1.7 _17	0.001*
Artesunate + SP	3 (8%)	8 (22%)	5.3	1.7 _17	0.001*
Halofantrine	3 (8%)	4 (11%	1.4	02 _ 8	0.07
Primaquine	1 (2.7%)	0	0	0-18	0.32

*Significant

Table 3. Pre- and post-intervention evaluation of prescribing practice of first-line anti-malaria drugs frequently prescribed by clinicians for treatment of uncomplicated *falciparum* malaria

Antimalaria drugs	Pre-Intervention (N = 49)	Post- intervention (N = 47)	OR	CI 95%	P-value
Artesunate + SP	11 (23%)	18 (38%)	2.2	0.8 _ 6	0.09
Chloroquine	10 (21%)	7 (15%)	0.63	0.2 _2.2	0.40
Sulphadoxine-pyrimethamine (SP)	1 (2%)	3 (6%)	3.2	0.3 _ 84	0.28
Quinine	3 (6%)	1 (2%)	0.33	0.01 _3.8	0.32
Artemether	8 (17%)	3 (6%)	0.35	0.07 _1.6	0.13
Lumefantrine + Artemether	10 (21%)	10 (22%)	1.05	0.35 _3	0.91
Halofantrine +SP	0	1 (2%)	NA	NA	0.30
Chloroquine +SP	0	1 (2%)	NA	NA	0.30
I did not know	5 (10%)	2 (4%)	0.4	0.05 _2.5	0.28

Table 4. Pre- and post-intervention evaluation of prescribing practice of anti-malaria drugs frequently prescribed by clinicians for treatment of malaria in pregnancy

Antimalaria drugs	Pre-intervention (N = 36)	Post-intervention (N = 37)	OR	CI 95%	P-value
Quinine	6 (17%)	22 (60%)	4.9	1.4 _17	0.004*
Artemether	17 (47%)	7 (19%)	0.26	0.08 _ 0.83	0.01*
Chloroquine	7(19%)	8 (22%)	1.14	0.3 _4	0.81
Sulphadoxine-pyrimethamine (SP)	1 (3%)	0	0	0 _ 17	0.31
Lumefantrine + Artemether	2 (6%)	0	0	0 _ 4	0.14
I did not know	3 (8%)	0	0	0 _ 2	0.07

*Significant

Table 5. Pre- and post-intervention evaluation of prescribing practice of anti-malaria drugs frequently prescribed by clinicians for treatment of severe malaria

Antimalaria drugs	Pre-intervention (N = 49)	Post-intervention (N = 47)	OR	CI 95%	P-value
Artesunate + SP	0	2 (4%)	NA	NA	0.16
Chloroquine	1 (2%)	0	NA	NA	0.32
Sulphadoxine-pyrimethamine (SP)	2 (4%)	1 (2%)	0.5	0.02 _ 7	0.58
Quinine	35 (72%)	37 (79%)	1.5	0.5 - 4	0.40
Artemether	5 (10%)	5 (11%)	1.05	0.24 _ 4.5	0.94
Lumefantrine + Artemether	1 (2%)	1 (2%)	1.04	0 _39	0.97
Artemether + SP	0	1 (2%)	NA	NA	0.30
I did not know	5 (10%)	0	0	0 _ 2	0.06

prescription was significantly reduced by clinicians for use for malaria in pregnancy from 47% pre-intervention to 19% post-intervention (P = 0.01) (Table 5). Artemether is prescribed by 79% of clinicians for the treatment of severe malaria (Table 5). Adherence by clinicians to the National Guidelines for anti-malaria drugs post-intervention was 38% for the prescription of artesunate + SP as a first-line treatment. Lumefantrine + artemether was also prescribed by 22% of the clinicians.

Discussion

This training intervention study for implementing a pilot model of a public/private approach to malaria case management and reporting targeted 86 health professionals working in 86 private health facilities of different categories (clinics and pharmacies). Training was conducted on October 2010 and reporting through active surveillance visits was initiated and followed for six months from November 2010 to April 2011. Two clinicians were lost to follow-up, as (one died and the other closed their clinic) giving a drop-out rate of 2.3%. In May 2011, a post-intervention survey was conducted to evaluate any post-intervention changes excluding the two follow-ups.

Current international policy initiatives emphasize the need for malaria control programs to collaborate with the for-profit private sector including pharmaceutical companies, drug distributors, and individual private health-care providers [10,13]. This project was designed to develop such a collaboration, focusing on three issues: surveillance, health professional's knowledge and practice, and anti-malaria drug marketing.

The World Health Organization (WHO) recommends treating uncomplicated *P. falciparum* malaria using Artemisinin-based combination therapy (ACT) [1]. In Yemen, the recommended changes in the anti-malaria treatment policy were adopted in 2005, but the policy was not implemented until 2009 through training and distribution of the National Guidelines for prescribing anti-malaria drugs [12]. The distribution of free-of-charge anti-malaria drugs is restricted to public health facilities and until the beginning of 2010 they were not available in the market.

Increasing availability and accessibility of ACTs will limit the usage of non-ACTs such as chloroquine. A Tanzanian study showed that anti-malaria monotherapy was being crowded out of the market [14]. In the current study, chloroquine is available in 80% of the studied pharmacies and was the most common drug purchased for malaria treatment in the pre-intervention period. Training intervention has shown that it is now the least sold anti-malaria drug in the market. Its monthly marketing numbers significantly decreased from 43% one month before the intervention to 11% six months post-intervention (P = 0.001) (Table 2).

Interventions to increase accessibility of ACTs in private pharmacies were supported by a subsidized artemisinin-based combination therapy approach in different developing countries, resulting in an increase in marketing and an increase in malaria patients being treated with ACTs [14,15]. In this pilot project, despite the marketing of ACTs and other recommended anti-malaria drugs, the private sector did not support any marketing interventions applied to increase the availability or use of ACTs in the private sector. However, marketing from private pharmacies of artesunate + SP and quinine increased significantly from 8% in the pre-intervention period to 22% post-intervention (P-value = 0.001) (Table 2). The availability of lumefantrine + artemether, the second-line anti-malaria combination therapy recommended by the NMCP, increased in private pharmacies from 19% before the intervention to 35% post-intervention (Table 1), and it was prescribed by approximately 22% of the clinicians for the treatment of uncomplicated *falciparum* malaria in both the pre- and post-intervention periods.

Controversial data were reported about the superiority of quinine and artemether injections for the treatment of severe malaria; systematic review studies have reported that there is clear evidence that supports the superiority of parental artemether over quinine for the treatment of severe malaria in both adults and children in different regions of the world [16]. Moreover, one study recommended that if the drug is approved by the US Food and Drug Administration (FDA) and commercially available, it would be the preferred agent for treatment of severe malaria in the USA [17]. On the other hand, another recent study reported that there was no evidence that treatment for severe malaria with parental artemisinin-derivatives was associated with lower mortality or long-term morbidity compared with parental quinine [18]. In this study, quinine and artemether injections were available and used frequently for the treatment of severe malaria. Quinine was the most prescribed anti-malaria drug by clinicians for the treatment of severe malaria (72% and 79% in the pre- and post-intervention periods, respectively) (Table 5). Furthermore, quinine prescription for the treatment of malaria in pregnancy increased significantly from 17% in the pre-intervention period to 60% post-intervention (P-value = 0.004).

Artemether was one of the most commonly available of anti-malaria drugs in private pharmacies (78% and 81% in the pre- and post-intervention periods, respectively) (Table 1); its marketing was reduced from 32% in the pre-intervention period to 24% in the post-intervention period (Table 2). Artemether is prescribed by 79% of clinicians for the treatment of severe malaria (Table 5).

Halofantrine has ototoxic [19] and fetal cardiotoxicity effects; however, in the rare situations in which halofantrine is the only therapeutic option available, it can still be given after carefully checking contraindications such as underlying cardiac diseases [20]. Halofantrine + SP and SP alone are not recommended in the new national anti-malaria dug policy [1,12]. Unfortunately, the halofantrine + SP combination is frequently prescribed by clinicians in the private sector in Sana'a city (18%).

Availability and use of ACTs in the private sector is subject to the knowledge of pharmacists and drugstore personnel, as well as good marketing. In this study, engagement with the pharmacists and drugstore personnel in reporting to the NMCP improved their commitment to the national policy for use of anti-malaria drugs, and also enhanced sharing common concepts about ACTs with clinicians, which resulted in increased drug availability and prescription practice in the private sector. Several studies were conducted in developing countries regarding prescription drug sellers and other health professionals in the private sector which showed poor knowledge about national policies and low a prescription rate of ACTs, with chloroquine the predominantly prescribed therapy [21,22,23]. Improving the prescription of ACTs and their availability in the targeted private health facilities in this study will encourage the NMCP to invest in the private sector.

Limitations of the study

This is a pilot implementation study conducted on a sample of the private health facilities in Yemen; not all the private sector facilities were involved. Expanding the project to all or most of the private

sector facilities needs strong investment by the NMCP toward the private sector.

Another limitation is that the project was designed to build on active surveillance; it provided valid data but routine surveillance in the control phase of disease epidemiology needs strong passive surveillance. Enhancing collaboration and engagement with the private sector in malaria reporting with a weak information system, as is the case in Yemen, is difficult, so active surveillance is needed.

Conclusion

This study provides evidence that training interventions and the involvement of private health-care providers in reporting procedures will promote appropriate prescription and marketing of anti-malaria drugs, especially ACTs, as recommended by the National Guidelines for the prescription of anti-malaria drugs in Yemen, and consequently strengthens the collaboration between the private health sector and the National Malaria Control Program.

There is a need for the National Malaria Control Program to involve pharmacists and drugstore personnel in further training activities. Promoting appropriate prescription of malaria drugs and behavior among private clinicians and pharmacists needs no more than training, information sharing, and good communication.

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