Nahom Tezera, Fre Alemseged, Meron Gudeta. Ethiop Med J, 2017, Vol.55, No. 3

ORIGINAL ARTICLE

KNOWLEDGE, ATTITUDE, AND PRACTICE (KAP) OF HEALTH EXTENSION WORKERS IN PRESCRIBING ANTIMALARIALS IN ASSOSA ZONE OF BENISHANGUL GUMUZ REGIONAL STATE (BGRS), NORTH-WESTERN ETHIOPIA

Nahom Tezera MD^{1*}, Fre Alemseged MD¹, Meron Gudeta, MD¹

ABSTRACT

Background: Despite the global efforts to control malaria, it claimed 500,000 lives worldwide in 2015. This was partly accounted for by the increase in the drug resistance of the parasite brought about by the misuse of antimalarials by health professionals, especially in poorly equipped setups, where appropriate diagnostic tests are not widely utilized. Accordingly, there has been no study of Knowledge, Attitude and Practice (KAP) of health extension workers (HEW), which are the providers of primary health care, in prescribing antimalarials in Ethiopia and Beni-Shangul Gumuz Regional State (BGRS) in particular.

Objectives: The main objective was to assess the KAP of HEWs in prescribing antimalarials in Assosa Zone of BGRS.

Methods: Survey of KAP of 341 HEWs in Assosa zone of BGRS was conducted with a cross-sectional study design using structured and pre-tested self-administered questionnaires between July 1, 2016- July 30, 2016.

Results: The study showed that 314 (93.7%) of the respondents identified the correct antimalarial for Plasmodium falciparum and 281 (86.2%) for Plasmodium vivax. However, only 117 (41.7%) were giving age/weight appropriate chloroquine dose for pediatric age group and 223 (79.5%) for adults. Regarding the attitude of HEWs, the study also revealed that 88 (26.1%) of the respondents claimed they were highly likely to treat patients with antimalarials for fever without carrying out diagnostic tests, while 115 (34%) claimed they would never do so. Also, regarding the likelihood of treating patients with antimalarials in the presence of negative RDTs, 91 (27%) claimed they were highly likely to treat patients with drugs despite negative RDT test results while 122 (36.2%) claimed not to do so.

Conclusion and Recommendation: Though the implementation of the HEP and participation of HEWs in malaria prevention and control improved community accessibility to prevention and control methods in the region markedly, this wider access needs to be balanced with appropriate use in order to minimize the problem of resistance. Providing refresher courses, supportive supervision, and improving the referral linkage between the health posts and health centers is recommended.

Keywords: HEWs, KAP, Antimalarial resistance, Assosa, BGRS

INTRODUCTION

Global efforts to control and eliminate malaria have saved an estimated 3.3 million lives since 2000; mortality rates decreasing by an impressive 47% between 2000 and 2013 globally, and by 54% in the WHO African Region (1). This has been brought about mainly by the expansion of prevention and control measures in spite of an increase in the global population at risk of malaria between 2000 and 2012. Despite the enormous control efforts however, increases in the drug resistance of the parasite, the insecticide resistance of its vectors, and human travel and migration were some of the contributing factors to the nearly 500 thousand lives it took in 2015 (2).

Of the interventional activities, case management and treatment of individual cases with Artemisinin Combination Therapy (ACTs) is shown to be the most efficacious; with estimates of malaria mortality reduction in children aged 1–23 months by 99% (range:94–100%), and in children aged 24–59 months by 97% (range: 86–99%) (3). However, this interventional modality is coming under increased threat with the emergence and spread of multi-drug resistant *P. falciparum* species, that could undermine recent gains in malaria control (4). A major factor

¹Addis Ababa University, College of Health Sciences, Department of Orthopedics * Corresponding author email: nahom_tezera@yahoo.com contributing to the development of artemisinin resistance is the uncontrolled use of ACTs including the widespread and/or misuse of antimalarials by health care professionals, especially in poorly equipped setups, where appropriate diagnostic tests aren't widely utilized (5, 6, 7). Programmatic influences on the development of antimalarial drug resistance include overall drug pressure, inadequate drug intake (poor compliance or inappropriate dosing regimens) and reliance on presumptive treatment. The use of presumptive treatment for malaria has the potential for facilitating resistance by greatly increasing the number of people who are treated unnecessarily but will still be exerting selective pressure on the circulating parasite population.

A study which reviewed 44 antimalarial efficacy studies conducted in Ethiopia from 1974 to 2011 indicated that chloroquine as the first-line antimalarial drug for the treatment of malaria due to P. falciparum had a 22% therapeutic failure in 1985. Chloroquine was replaced with sulfadoxine-pyrimethamine, as a first line treatment for *P. falciparum* in 1998, more than 12 years later, when its therapeutic failure had reached 65%. Sulfadoxine-pyrimethamine at the time of its introduction had a treatment failure rate of 7.7%; it was replaced after seven years in 2004 by artemether-lumefantrine; by then its treatment failure had reached 36% (8, 9).

Almost eight years after its introduction, isolated localized studies show that the efficacy of artemether -lumefantrine has decreased from 99% in 2003 to around 96.3% in 2008. Though this decrease is not statistically significant (chi-square 1.5; P=0.22) and has not reached the threshold of 10%, it is plausible that its efficacy may drop further (8,10), and with there being no prospect of an effective new antimalarial drug development in the pipeline, the identification of the causative factors and the implementation of corrective interventions is paramount.

In our setup, since 2004, the government of Ethiopia has made bold decisions to strengthen and expand its primary health care system by launching the Health Extension Program (HEP). While the scaling up of the HEP is necessary to achieve the aim of universal access to primary health care, close attention should be paid to the performance of the program. A study aimed to estimate the technical efficiency of a sample of health posts in rural Tigray has revealed that only a quarter of the health posts are working efficiently and pointed to the need for improvement; and recommended a closer monitoring of the health extension programme in order to achieve the best possible performance (11,12). Similar studies into the rational use of antimalarials by HEWs at the national, as well as regional levels, are lacking, hence this research is carried out to assess the KAP of HEWs in prescribing these drugs in Assosa zone of BGRS.

PATIENTS AND METHODS

The study was carried out in Assosa zone of Benishangul-Gumuz regional state (BGRS), which is located in the north-western part of the country. Assosa zone is subdivided into 7 administrative woredas which are further divided into a total of 210 Kebeles. In this zone, there is a total of 146 health posts with 395 health extension workers (379 in rural and 16 in urban health posts).

A descriptive cross–sectional census study of all HEWs in the 7 woredas and 210 Kebeles of Assosa Zone was conducted between July 1/2016- July 30/2016 using pre-tested questionnaires that assessed the KAP of HEWs in prescribing anti-malarial drugs. The questionnaires were partly self-administered and partly administered by trained professionals.

The knowledge of HEWs was assessed through their awareness of symptoms, cause, transmission, prevention, and treatment of malaria–including drugs, dosage and duration of treatment. Their attitude was assessed with regards to their likelihood of presumptive treatment, preference for using certain antimalarials, and the likelihood of referral to higher health institutions. Practice was assessed through their implementation of adequate documentation, prescribing, follow up and counseling of patients suspected of the disease. Other parameters assessed included educational background, years of experience, and access to refresher training.

Data was collected through a structured and selfadministered questionnaire which was initially developed in English and translated into the local language (Amharic) for administration. The questionnaire was pre-tested and the collected data, manually checked for consistency and completeness ascertained by investigators on daily basis before being entered into the SPSS20.0. All filled questionnaires were collected daily and kept in a secure place by the investigators.

The study design involved the use of selfadministered questionnaires to the respondents to gather information on their knowledge, attitude, and practice based on informed consent. Although the HEW are legally mandated to provide primary health care service in Ethiopia, further precautions were taken to ensure the safety of patients through close monitoring of activities of the health workers. All the information gathered from the study is kept confidential by giving a specific code; moreover, the study proposal was cleared by the regional health bureau ethical review committee.

RESULTS

Socio-demographic characteristics of the study subjects: Data was collected from 341 Health Extension Workers working in the seven woredas of Assosa Zone of Benishangul Gumuz Regional State. Of these HEWs, 112(32.8%) were from Assosa Woreda, 78 (22.9%) from Bambasi, 40 (11.7%) from Oda, and 37 (10.9%) from Menge (Fig. I shows total population of Assosa zone by woreda). The mean age of the respondents was 23.34 years (\pm 2.79) SD, the majority being in the age group 18-25 (80.5%) and the oldest being 36. Among the respondents, 50 (15.2%) had got a recent refresher training on malaria treatment and diagnostics in the past year, whereas 280 (84.8%) claimed they had not. The largest group (48.4%) reported work experience as community health extension worker of 4-6 years (Fig 2 shows distribution of HEWs by years of work experience).

Knowledge on Malaria: Regarding the different etiologic species of malaria in the region, 216 (63.3%) stated both *P. falciparum* and *P. vivax*, 54 (15.8%) P. vivax only, and 42 (12.3%) identified *P. falciparum* as the etiologic species. Moreover, 262 (79.2%) correctly knew the female anopheles mosquito as the vector responsible for malaria transmission, while 69 (20.8%) did not.

Signs/Symptoms: Of the knowledge of the signs and symptoms of malaria, 327 (95.9%) of respondents noted fever as a presenting sign, whereas 317 (93%) noted headache, 305 (89.4%) chills and rigor, 281 (82.4%) sweating, 266 (78%) vomiting, 245 (71.8%) nausea, 213 (62.5%) arthralgia, and 65 (19.1%) dry cough.

Treatment and Dosage: With regards to the appropriate drug of choice for the common species of malaria, 314 (93.7%) of the respondents identified the correct antimalarial for *P. falciparum* and 281 (86.2%) for *P. vivax*. Of those who documented the proper drug of choice for *P. falciparum*, only 257 (81.8%) were giving age/weight appropriate coartem dose for pediatric age group and 255 (81.4%) for adults. Of those identifying the proper drug of choice for *P. vivax*, only 117 (41.7%) were giving age/weight appropriate chloroquine dose for pediatric age group and 223 (79.5%) did likewise for adults (Table 1).

Prevention and Prophylactic Drugs: With regard to the types of malaria preventive methods, 324 (95%) knew about insecticide-treated bed nets, 290 (85%) indoor residual spray, 204 (59.8%) repellents, and 170 (49.9%) prophylactic drugs as methods of preventing malaria. Moreover, 302 (88.8%) correctly identified special population groups (pregnancy, under-five children) as those requiring priority to receive malaria prophylaxes. Of those that identified prophylactic drugs as possible preventive methods, 124 (73.2%) identified at least one antimalarial drug (respondents were made to choose among Doxycycline, Mefloquine, and Chloroquine), 22 (13.1%) didn't know any antimalarial drug, 15 (8.9%) identified three antimalarial drugs and 8 (4.8%) identified two antimalarial drugs.



Figure 1. Total population of Assosa zone by woreda (2008 EC)



Table 1: Summary of knowledge of HEW on prescribing anti-malarial drugs in Assosa zone of Benishangul Gumuz region, 2016

		Count	Column Valid N %
Knowledge of Proper Coartem Pediatric Dos-	Correct	272	79.8%
age.(N=341)	Incorrect	69	20.2%
Knowledge of Proper Chloroquine Pediatric	Correct	125	38.1%
Dosage. (N=328)	Incorrect	203	61.9%
Knowledge of Proper Coartem Adult Dosage.	Correct	269	79.8%
(N=337)	Incorrect	68	20.2%
Knowledge of Proper Chloroquine Adult Dos-	Correct	255	76.6%
age. (N=333)	Incorrect	78	23.4%
Knowledge of Proper Antimalarial Drug of	Correct	120	37.0%
Choice for < 5kg Children. (N=324)	Incorrect	204	63.0%
Knowledge of Proper Antimalarial Drug of	Correct	134	41.9%
Choice for First Time Pregnancy (N=320)	Incorrect	186	58.1%
Knowledge of Common etiologies of Malaria in	Correct	42	43.8%
Ethiopia. (N=96)	Incorrect	54	56.2%
Knowledge of Vector responsible for transmis-	Correct	262	79.2%
sion. (N=331)	Incorrect	69	20.8%
Knowledge of Conducive environment	Correct	113	33.4%
Factors for malaria transmission. (N=338)	Incorrect	225	66.6%
Knowledge of mosquito biting time (N-339)	Correct	124	36.6%
Knowledge of mosquito biting time. (N=339)	Incorrect	215	63.4%
Knowledge on who needs Special prevention.	Correct	302	89.9%
(N=336)	Incorrect	34	10.1%
Knowledge of primary Antimalarial Prophylac-	Correct	256	93.8%
tic drugs for travelers. (N=273)	Incorrect	17	6.2%
Knowledge on Preferred Drug of Choice for	Correct	314	93.7%
Plasmodium falciparum. (N=335)	Incorrect	21	6.3%
Knowledge on Preferred Drug of Choice for	Correct	281	86.2%
Plasmodium vivax. (N=326)	Incorrect	45	13.8%

Attitude regarding malaria treatment: Respondents were asked about the likelihood of treating patients with fever with antimalarial drugs without workup. Of all respondents, 88 (26.1%) claimed they were highly likely to treat patients with antimalarials, while 135 (39.9%) of the respondents were less likely, with 115 (34%) claiming they would never treat without workup. With regards to the likelihood of treating patients with antimalarials in the presence of negative RDTs, 91 (27%) claimed they were highly likely to treat patients, 124 (36.8%) claimed they were less likely, with 122 (36.2%) claiming to never treat in the presence of negative RDT test result.

For cases described as severe malaria, 161 (48.3%) of the respondents were highly likely to treat patients with oral (per os) antimalarials even if they presented with severity signs, 85 (25.5%) were less likely to do so, and 87 (26.1%) claimed they would never engage in similar practice. When further questioned on the likelihood of referring such patients to higher health centers/hospitals, 253(74.4%) of the respondents were highly likely to refer such patients to hospital, 59(17.4%) were less likely to do so, whereas 28 (8.2%) claimed they wouldn't engage in a similar practice.



Figure 3. Attitude of HEWs regarding likelihood of treating patients with antimalarials despite negative RDTs in Assosa zone of BG region, 2016



Likelihood of referring patients with Severe malaria to higher hospitals

Figure 4. Attitude of HEWs regarding likelihood of referring patients with severe malaria to higher health centers/ hospitals among the seven woredas of Assosa zone of BG region, 2016. Numbers indicate: 1: never, 2: low, 3: medium, 4: high, 5: very high

Practice on Malaria Case Management: With regards to the routine use of RDTs in diagnosing patients suspected of malaria, 303 (89.3%) of the respondents claimed to always/often use it, whereas 36 (10.6%) claimed to use RDTs seldom/never. More than two-thirds, 219 (68.7%) claimed to use references in prescribing antimalarials to young children, whereas the remaining 100 (31.3%) claimed to do so seldom/never. With regard to regular counseling of

patients on methods of transmission and preventive aspects of the disease, 313(92.3%) of the respondents claimed to do so always/often, with the remaining 26 (7.7%) claiming to engage in similar practice seldom/never. On the question of the availability of both antimalarial drugs and RDTs at health post level, only 222 (66.2%) reported of availability always/often (Table 2).

Table 2: Summary of practices of HEW on treatment of malaria	cases in
Assosa zone of Benishangul Gumuz region, 2016	

		Count	Column Valid N %
Proper use of RDTas a routine practice. (N=339)	Non-response	2	0.6
	Always	272	79.8
	Frequent	31	9.1
	Never	6	1.8
	Seldom	30	8.8
Routine use of reference in anantimalarial prescription for children. (N=339)	Non-response	22	6.5
	Always	184	54.0
	Frequent	35	10.3
	Never	17	5.0
	Seldom	83	24.3
Practice on advising on dosing frequency	Non-response	2	0.6
	Always	290	85.0
	Frequent	26	7.6
	Never	4	1.2
	Seldom	19	5.6
	Non-response	2	0.6
Duenen menden eenneding of notionts on	Always	271	79.5
the methods of transmission. (N=339)	Frequent	42	12.3
	Never	2	0.6
	Seldom	24	7.0
Availability of antimalarials in health posts. (N=339)	Non-response	7	2.1
	Always	177	51.9
	Frequent	64	18.8
	Never	7	2.1
	Seldom	86	25.2
	Non-response	2	0.6
Availability of RDT at health posts. (N=339)	Always	197	57.8
	Frequent	57	16.7
	Never	8	2.3
	Seldom	77	22.6
Documentation of cases treated as malaria on HMIS registration. (N=338)	Non-response	3	0.9
	Always	271	79.5
	Frequent	24	7.0
	Never	18	5.3
	Seldom	25	7.3

DISCUSSION

In this study, the KAP of health extension workers in prescribing anti-malarial drugs in Assosa Zone of Benishangul Gumuz regional state was assessed. The present study showed that 81.6% of the HEWs treating P. falciparum with the proper drug were doing so in the right dose for pediatric age group and adults. This number declined significantly, with only 41.7% of the HEWs treating P. vivax with the proper chloroquine dose for pediatric age group and 79.5% doing likewise for adults. This could be explained by the meager use of references in prescribing age/ weight appropriate antimalarial doses to young children, with a third (31.3%) claiming to seldom/never use. Poor prescribing of antimalarials, mostly chloroquine, and quinine, was also seen in a prospective survey of 400 prescriptions in Sudan, which found recommended dosage regimens being followed in only 55% of cases (15, 16).

For a significant impact on malaria transmission, an integrated, multi-pronged application of malaria vector control interventions is recommended (17). The integrated vector control approach, consisting of ITNs and environmental control coupled with IRS and prophylactic tablets, can impact not only malaria transmission but also benefit the malaria diagnosis and treatment intervention as it helps reduce the number of new malaria cases (8). Though 100% of the respondents knew about the use of ITNs to prevent malaria transmission, only 37.8% knew about other modes of prevention/prophylaxis like drugs, IRS, and repellants. In contrast, a study done in Tigray indicates environmental management (82.3%) and impregnated bed nets (46.2%) were the most commonly mentioned preventive strategies (14). Hence, more needs to be done to train HEWs in the different prongs of malaria vector control intervention.

Presumptive treatment of fever in children <5 years of age with antimalarial drugs, unless an alternative cause for the fever is diagnosed, was for many years recommended in malaria-endemic countries of sub-Saharan Africa. This approach to the diagnosis of febrile illness in children, incorporated within the Integrated Management of Childhood Illness (IMCI), was part of the reason why nearly 80% of all malaria cases reported were unconfirmed (18). However, the use of antimalarial drugs based on clinical diagnosis resulted in the overutilization of the antimalarial drugs and helped to facilitate the selection of resistant strains through drug pressure (19). And it was one of the reasons why the earlier recommendations had to be scrapped. In addition, endorsement of the presumptive approach to diagnosis contributed to an overemphasis on malaria and the under-diagnosis of non-malaria fevers, leading to wastage of antimalarial drugs, with possible adverse medical and economic consequences (20). Our findings on presumptive treatment of patients with fever without workup indicate that 26.1% of the respondents were highly likely to treat with antimalarial drugs. Considering the fact that more than half of patients who visit HEWs and private health facility services present with fever (13) the number of patients treated presumptively for malaria is a mammoth figure. And is in direct contradiction to WHO's revised malaria treatment guidelines (21) and EFMOH guideline (2010), which recommend parasitological confirmation by microscopy or by rapid diagnostic test (RDT) in all patients including children suspected of malaria before starting treatment. The new WHO and national guidelines, if adhered to by the HEWs, would address the problem.

The above findings are also replicated among HEWs with regard to their likelihood of treating patients with antimalarials in the presence of negative RDTs. Around 27% claimed to do so most of the time and they were highly likely to treat patients. This further contributes to drug pressure, as a negative diagnostic workup isn't being used to exclude the diagnosis of the disease and antimalarials continue to be prescribed despite the evidence to the contrary. Studies in other settings have also confirmed this trend in which clinicians were reluctant to refrain from treating malaria even after a negative RDT test. In another study, 80 to 85% of RDT-negative febrile patients were treated for malaria (22) while still another study reported a level as low as 17% (23). This noncompliance with the test results in our study may be associated with the fact that 11 years after the introduction of RDTs in the study area, no effort had been made by the local health bureau to monitor and supervise the health workers on the use of RDTs (only 15.7% reported recent refresher trainings). Thus, the initial zeal to adhere to RDT results experienced in the early phase of the RDT introduction may have waned (24).

Conclusion: In conclusion, though the implementation of the HEP and participation of health extension workers in malaria prevention and control increased community accessibility to prevention and control methods in the region, this wider accessibility to antimalarial drugs needs to be balanced with appropriate use in order to minimize the problem of resistance and treatment failure. Our research findings indicate that utilization of RDTs for malaria diagnosis and recognition of the clinical symptoms of malaria is often not adequate and there is a misuse of antimalarial drugs for the wrong indications and in inappropriate doses among HEWs in the zone. Supportive supervision to strengthen disease management and diagnosis with RDTs by HEWs has not been well coordinated and there are not adequate mechanisms and systems for quality assurance of malaria diagnostic procedures by HEWs using RDTs along with timely refresher training.

Recommendation: The finding from this study confirmed that more needs to be done from concerned bodies to ensure that standardized quality of care is rendered by the HEWs, these include:

- Providing refresher courses, audit and feedback combined with either seminars or academic detailing to HEWs in the region, which will mainly assist in improving the quality of the program.
- Supportive supervision, including monitoring and evaluation of the quality of care, and promoting awareness in the community to improve appropriate delivery and utilization of ACTs by HEWs, especially in rural areas.
- Improving the availability of essential resources (RDT, antimalarial drugs, and references for drug dosage) in the health post.
- Improving the referral linkage between the health posts and health centers, and conducting regular catchment area meetings which would serve as mentorship programs, to further capacitate HEWs.

REFERENCE

- 1. White NJ, Pukrittayakamee S, Hien TT, Faiz MA, Mokuolu OA, Dondorp AM. Malaria. Lancet, 383(9918), 165-76. Lancet. 2014 Feb 22;383(9918):723-35
- 2. World Health Organization. World Malaria Report 2015. World Health, p. 243. Available at www.who.int/ malaria/publications/world-malaria-report-2015/en/ (last accessed 9 June 2017)
- 3. Thwing J, Eisele TP, Steketee RW. Protective efficacy of malaria case management for preventing malaria mortality in children: a systematic review for the Lives Saved Tool. BMC Public Health 2011, 11 (Suppl 3): S14.
- 4. Ashley EA, Dhorda M, Fairhurst RM, et al. Spread of Artemisinin Resistance in *Plasmodium falciparum* Malaria. The N Engl J Med 2014; 371(5):411-23.
- 5. Chrubasik C, Jacobson RL. The development of artemisinin resistance in malaria: reasons and solutions. Phytother Res. 2010 Jul; 24(7):1104-6.
- 6. Medhanyie A, Spigt M, Dinant G, Blanco R. Knowledge and performance of the Ethiopian health extension workers on antenatal and delivery care: a cross-sectional study. Human Resources for Health. 2012; 10:44.
- Bloland, PB. Drug resistance in malaria. WHO/CDS/CSR/DRS/2001.4 World Health Organization, 2001; 41: 45–53. Available at: http://www.who.int/csr/resources/publications/drugresist/malaria.pdf (Last accessed 9 June 017)
- 8. Yohannes AM. Malaria treatment in Ethiopia: antimalarial drug efficacy monitoring system and use of evidence for policy (Doctoral dissertation, June, 2012, University of South Africa). Available at http://uir.unisa.ac.za/handle/10500/8668 (last accessed 9 June 2017)
- 9. Kelly JM, Osamba B, Garg RM, et al. Community Health Worker Performance in the Management of Multiple Childhood Illnesses: Siaya District, Kenya, 1997–2001. Am J Public Health. 2001; 91(10):1617-24.
- 10. Fagbule D, Kalu A. Case management by community health workers of children with acute respiratory infections: implications for national ARI control program. J Trop Med Hyg. 1995 Aug; 98(4):241-6.
- 11. Oxfam. Salt, Sugar, and Malaria Pills. Oxfam Briefing Paper. 2012; (163): 1–28. Available at https://www.oxfam.org/sites/www.oxfam.org/files/bp163-affordable-medicine-facility-malaria-241012-en.pdf (Last accessed 9 June 2017)
- 12. Sebastian, MS, Lemma H. Efficiency of the health extension program in Tigray, Ethiopia: a data envelopment analysis. BMC Int Health Hum Rights 2010, 10(1): 16.

- 13. Deressa W, Ali A, Enquoselassie F. Knowledge, attitude and practice about malaria, the mosquito, and antimalarial drugs in a rural community. Ethiop J Health Develop. 2003; 17(2):99-104.
- 14. Paulander J, Olsson H, Lemma H, Getachew A, San Sebastian M. Knowledge, attitudes and practice about malaria in rural Tigray, Ethiopia. Global Health Action. 2009 Jan 13; 2.
- 15. World Health Organization (WHO). Drug resistance. 2015;77–90. Available from: www.who.int/ drugresistance
- 16. Awad AI, Ball DE, Eltayeb IB. Improving rational drug use in Africa: the example of Sudan. East Med Health J. 2007; 13(5):1202-11.
- 17. World Health Organization (WHO). Malaria Control today: Current WHO Recommendations. March 2005. Available at http://www.who.int/malaria/publications/atoz/mct_workingpaper/en/ (Last accessed 9 June 2017)
- 18. World Health Organization (WHO). World Malaria Report 2009. WHO, Geneva.
- 19. D'Alessandro U, Buttiens H. History and importance of antimalarial drug resistance. Trop Med Int Health. 2001 Nov 1; 6(11):845-8.
- 20. Amexo M, Tolhurst R, Barnish G & Bates I. Malaria misdiagnosis: effects on the poor and vulnerable. Lancet 2004; 364:- 1896–8.
- 21. World Health Organization (WHO). Guidelines for the Treatment of Malaria, 2010, 2nd edition. WHO, Geneva.
- 22. Bisoffi Z, Gobbi F, Angheben A, Van den Ende J. The role of rapid diagnostic tests in managing malaria. PLoS Med. 2009 Apr 28; 6(4):e1000063.
- 23. Bisoffi Z, Sirima BS, Angheben A, Lodesani C, Gobbi F, Tinto H, Van den Ende J. Rapid malaria diagnostic tests vs. clinical management of malaria in rural Burkina Faso: safety and effect on clinical decisions. A randomized trial. Trop Med Int Health. 2009 May 1; 14(5):491-8.
- 24. Uzochukwu BS, Onwujekwe E, Ezuma NN, Ezeoke OP, Ajuba MO, Sibeudu FT. Improving rational treatment of malaria: perceptions and influence of RDTs on prescribing behaviour of health workers in southeast Nigeria. PLoS One. 2011 Jan 31;6(1):e14627.