Introducing Malaria Rapid Diagnostic Tests (MRDTs) at Registered Retail Pharmacies in Ghana: Practitioners’ Perspective

Audu Rauf¹,², Berko Panyin Anto², George Asumeng Koffuor³*, Kwame Ohene Buabeng² and Mohammed Abdul-Kabir⁴

¹Kama Health Service, KNUST, Kumasi, Ghana.
²Department of Clinical and Social Pharmacy, Faculty of Pharmacy and Pharmaceutical Sciences, College of Health Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
³Department of Pharmacology, Faculty of Pharmacy and Pharmaceutical Sciences, College of Health Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
⁴Department of Optometry and Visual Science, College of Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Authors’ contributions

Authors AR, BPA and GAK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KOB and MAK managed the analyses of the study. Authors AR, BPA and GAK managed the literature searches. All authors read and approved the final manuscript.

ABSTRACT

Aims: In much of Africa, Ghana inclusive, malaria has traditionally been diagnosed and treated presumptively: any patient with fever was presumed to have malaria and treated with antimalarial drugs. In this study, the retail pharmacies practitioners’ perspectives on the implementation of Malaria Rapid Diagnostic Tests was sought and decisions analyzed in themes, using Realist Conceptual Approach.

Study Design: Cross-sectional quantitative and purposive study.
Place and Duration of Study: Registered private pharmacies in Ashanti Region of Ghana, between September and November, 2013.
Methodology: A structured pre-tested questionnaires (in non-study area) was self-administered to 99 practitioners in retail pharmacies to generated information on Practitioner’s characteristics, knowledge and experience on the MRDT kits, acceptance and willingness to use the test kits and challenge towards the use of the kit, for the thematic analysis.

Results: Practitioners within the age bracket of 30-40 years were highest (43%) and male representation was 67%. Pharmacists were 67% of practitioners and 17.1% had postgraduate qualification. 96.03% had ample knowledge of test kit and 0.99% use it always and logistic regression indicated no significance (Chi-square=0.751; LR=0.540 at p<0.05). Of the patients, 47.52% strongly agree to implement and 48.51 agree. 60.39% were definite to suggest to colleague and logistic regression indicated significant relation (Chi-square=0.000; LR=0.006 at p<0.05). 44.4% were very satisfied with presumptive diagnosis while 1% very dissatisfied.

Conclusion: The findings indicated willingness to implement the policy but presumptive diagnosis is still the practice. The evidence provides an opportunity to adapt a conceptual framework leading to the uptake of the policy.

Keywords: Malaria rapid diagnostic test; presumptive malaria treatment; realist concept approach; private retail pharmacies.

1. INTRODUCTION

In this study, the retail pharmacies practitioners’ perspectives on the implementation of Malaria Rapid Diagnostic Tests was sought and decisions analyzed in themes, using Realist Conceptual Approach. The management of febrile conditions in malaria-endemic countries has received considerable attention in recent past, with huge efforts to scale up the use of Artemisinin-based Combination Therapy (ACT) for malaria cases. In much of Africa, Ghana inclusive, malaria has traditionally been diagnosed and treated presumptively: any patient with fever was presumed to have malaria and treated with antimalarials. Presumptive diagnosis worked well when the most commonly used antimalarials- Chloroquine (CQ), Sulfadoxine/Pyrimethamine (SP) and Amodiaquine (AQ) – were cheap, effective, safe and widely available. The introduction of more expensive ACT due to reported resistance strains developed by those antimalarials had necessitated a policy shift, thereby, reconsidering existing strategies of blanket antimalarial use for fever cases in favour of restricted antimalarial prescription based on evidence of malaria parasitaemia [1].

In Africa, Zambia was the first country to introduce ACTs, revise their malaria treatment policies and introduce Malaria Rapid Diagnostic Tests (MRDTs), to improve targeting antimalarial drugs in older children and adults; to fall in line with World Health Organization (WHO) directives [2]. In 2009, Ministry of Health, Ghana, in line with the WHO directives, reviewed its diagnostic procedure to parasites-confirmation prior treatment, as a measure to curb over diagnosis and misdiagnosis of malaria and over prescription of antimalarial drugs. Studies had shown that microscopy testing for malaria in Africa is not readily available in low resource health institutions due to its dependence upon skilled laboratory staff and technical equipment. The accuracy of results is compromised if either staff skills or equipment are lacking [3,4]. For parasitological diagnosis to be taken up in low-resource settings, tests that can be carried out without extensive skills or equipment are needed. The new technology of MRDTs fits into this criteria, offering accurate diagnosis [5] in a relatively simple format that requires no electricity or specialized laboratory training [6]. However, endorsing a new or
improved health technology in itself does not guarantee end-user utilization, especially in resource-poor countries where government health facilities are underfunded, ineffective, or underutilized. About half the world’s population is at risk of malaria and the disease is estimated to cause some 250 million cases of clinical illness and account for between 1-3 million deaths annually [7].

Malaria is still an important public health problem in the developing world and in sub-Saharan Africa [8]. A major source of antimalarial treatment in many settings is private Pharmacies and this has led to calls to consider including these drug shops in the scale up of MRDTs [9]. Three (3) years of the new technology (MRDTs) policy in Ghana, a clustered, randomized survey was conducted in Community Health Care Facilities in Ghana [10] examining the diagnostic procedures in the treatment of uncomplicated malaria (which formed the baseline for the main trial) revealed non-adherence to the policy and the practice of diagnosis is still predominantly presumptive; as in a case in Zambia [11], even where microscopy were available. Malaria Rapid Diagnostic Tests has been extensively evaluated in several studies to investigate their diagnostic performance by health workers in health systems and found to be of sensitive and specific with high predictive values [12-15], including willingness to pay for such tests [16]. However, there is a paucity of retail pharmacy-based studies investigating into the willingness to implement MRDTs, with no published data on frequency of use or adherence to results.

Ghana has a policy of National Health Insurance Scheme (NHIS). In this scheme registered persons access medical attention in pharmacies (including private pharmacies accredited to the scheme) without direct out-of pocket payments. Therefore, implementing MRDTs at retail pharmacies has the potential to make significant contribution to targeting antimalarial drugs to those with malaria parasites and the impact will be contingent upon how the practitioners use the tests and applying the results.

In this study, the retail pharmacies practitioners’ perspectives on the implementation of MRDTs was sought and decisions analyzed in themes, using Realist Conceptual Approach, which seeks to better understand what works for whom, in what circumstances and why [17]. This concept provides a rigorous procedure to analyze heterogeneous data emerging from multiple disciplines as a means to develop a new strategic model, understand the relationships between them, and identify the evidentiary base underpinning them, where traditional system would often conclude that there is no evidence to inform next steps [18].

2. MATERIALS AND METHODS

2.1 Study Design

The results presented in this study were a formative research component prior to a randomized trial of the introduction of MRDTs in registered private pharmacies in Ashanti Region of Ghana. It was a cross-sectional qualitative and purposive study to understand the willingness of and acceptability by private retail pharmacy practitioners and how clients/patients perceive the implementation of MRDTs, in order to inform intervention and design a strategy model.
2.2 Study Area

The Ashanti Region of Ghana was used as the study area because of perennial malaria transmission, high concentration of registered private retail pharmacies and availability of antimalarial drugs and diagnostic kit. The total number of registered private pharmacies in Ashanti Region was 292, at the time of study [19] and a private retail pharmacy is superintendent by a registered pharmacist and supported by other auxiliary staff.

2.3 Sampling Technique and Sample Size

For multivariable analyses and factor analysis, everything depends on everything else. No exact predictions are really feasible and consequently, rules of thumb are often adopted, that the sample size should be 5, 10, or 20 times the number of variables. In this study, the predictors were 20, therefore the sample size of (5x20) 100 was used as respondents and a sample sizes of 100 respondents would meet the most stringent rule of thumb [20]. The first and the last 50 private retails pharmacies to register with the regulatory body (Pharmacy Council) in Ashanti Region were conveniently selected to represent the study area.

2.4 Study Instrument

The study instrument was a structured pre-tested questionnaire (in non-study area) designed to conform to Realist Concept Approach which was self-administered and generated information for the thematic analysis. A practitioner per study area was purposively selected based on the likelihood of having useful opinions or knowledge about the study objective. The categorizations of the theme were:

- Practitioner’s characteristics.
- Practitioner’s knowledge and experience on the test kit.
- Practitioner’s acceptance and willingness to use the test kit.
- Practitioner’s challenge towards the use of the kit.

2.5 Data Collection and Management

The investigator explained the purpose of the study and answered some concerns from respondents where necessary. The exercise transversed between September and November, 2013, to retrieve the completed five-page-21-questions questionnaires from respondents. The analysis started with manual transcription of all the qualitative data from completed interview questionnaires and annotated with numerical codes. They were examined in line with the thematic subtitles with the attributes of the conceptual framework that relates willingness, acceptance and implementation of MRDTs.

2.6 Limitations to the Study

The data collection method used (questionnaire) did not offer the practitioners enough latitude to come out with more information like an in-depth interview could have provided. The study assumed the suggestions of practitioners to represent that of the care-seekers on the probability of accepting the new technology. Hawthorne’s effect could have effect on the responses of some practitioners since they knew it was a study and could present information that was actually not the case.
The limitations as regards to the questionnaire and Hawthorne’s were taken care of by the sampling technique of rule of thumb and the assumption of practitioners representing the care-seekers was based on closeness, thrust and mutual co-operation which position the practitioners in a better stead to make such suggestions.

2.7 Data Analysis

Analysis was performed with SPSS version 19. Logistic regression, likelihood Ratio (LR) and Pearson Chi-square were used to establish statistical significance of the themes. The level of significance was fixed at 5% for all analyses.

3. RESULTS

3.1 Practitioners’ Characteristics

Table 1 shows the age (years) categories of 99 practitioners (whose questionnaires were retrieved) with 30 – 40 year band having the highest representation of 43%. The Mean and Standard Deviation (SD) of the age categories were 2.99 and 0.759 respectively. Their professional status were illustrated in Table 2, with pharmacists, having the highest (67%) representation and of the practitioners, 67% were males.

| Age Categories  | Frequency | Percent |
|-----------------|-----------|---------|
| 20 – 30 years   | 29        | 29.3    |
| 30 – 40 years   | 43        | 43.4    |
| Above 40 years  | 27        | 27.3    |
| Total           | 99        | 100     |

| Professional status             | Frequency | Percent |
|--------------------------------|-----------|---------|
| Pharmacist                      | 67        | 67.7    |
| Intern Pharmacist               | 11        | 11.1    |
| Dispensing Technician           | 14        | 14.1    |
| Medicine Counter Assistant      | 7         | 7.1     |
| Total                           | 99        | 100     |

Their educational levels were considered in the data extraction, which was presented in Table 3. The registered pharmacists with post-graduate degree superintending private registered retail pharmacy in this study were 17.1% and those with graduate (first) degree 63.6%. The participants with university degree had the highest cumulative percentage (80.7%) and Higher National Diploma (HND) degree holders as 13.1%.

| Educational level                  | Frequency | Percent |
|------------------------------------|-----------|---------|
| Postgraduate degree                | 17        | 17.1    |
| Graduate degree                    | 63        | 63.6    |
| Higher National Diploma            | 13        | 13.1    |
| Medicine counter certificate       | 6         | 6.1     |
| Total                              | 99        | 100     |
3.2 Practitioners’ Knowledge and Experience with the MRDT Kit

The results indicated majority of the practitioners 96.03% had ample knowledge of the MRDTs deployment as a new diagnostic technology and 0.99% were found to be using the new technology ‘always’. The practitioners who ‘never’ used the test kit were 58.41% while 38.61% ‘sometimes’ and 0.99% ‘usually’. Of the practitioners with knowledge of the test, 70.3% (45/64) were through Scientific Conference, 10.9% (7/64) Print/electronic media, 10.9% (7/64) Professional Colleagues and 1.6% (1/64) each through Scientific Journal and Patients. Logistic Regression to determine the statistical significance of medium of information (as a means of knowledge) and usage of test by keeping educational level of practitioners constant had Pearson Chi-square of 0.751 and Likelihood Ratio (LR) of 0.540. No statistical significance was found at p<0.05.

3.3 Practitioners’ Acceptance and Willingness to Use MRDT Kit

Of the practitioners, 47.52% and 48.51% ‘strongly agree’ and ‘agree’ respectively to willingly implement MRDTs; while 1.98% were ‘neutral’ and 0.99% ‘disagree’. Just above sixty percent (60.39%) were ‘definite’ to suggest to colleagues, 33.66% ‘probably’, 3.96% ‘not sure’ and 0.99% ‘probably not’. Logistic regression was applied to ascertain the statistical significance of ‘reasons’ and ‘suggest to colleague’ as an index of acceptance and willingness to use the test kit, by keeping professional status constant, had Pearson Chi-square of 0.000 and LR of 0.006. This indicated statistical significance in relationship at p < 0.05. Practitioners’ assessment of patient’s probability to accepting MRDTs is considered critical to the implementation and 36.63% ‘very sure’ that patients would accept the technology, 44.55% ‘somewhat sure’, 3.96% ‘neither sure nor unsure’, 2.97% ‘somewhat unsure’ and 10.89% ‘not very sure’.

3.4 Practitioners’ Challenges towards the Use of MRDT Kit

Practitioners’ satisfaction to Presumptive Diagnosis (PD) had been identified as a challenge to the use of MRDTs. A little above forty-four percent (44.4%) were ‘very satisfied’ and 1% ‘very dissatisfied’ as in Table 4. Of the practitioners, 39.6% identified cost component (affordability) and convenience integrating MRDTs in their practice as a challenge, 21.8% ‘not sure of regular supply and storage of the test kit, 21.8% ‘not very sure of the sensitivity and specificity of the test’, 12.9% thought ‘cultural, religious and traditional beliefs in using blood during the process’ and 2.9% thought ‘always training of new staff’ was a challenge to the implementation.

| Frequency | Percent |
|-----------|---------|
| Very dissatisfied | 1 | 1.0 |
| Somehow dissatisfied | 9 | 9.1 |
| Neither satisfied nor dissatisfied | 5 | 5.1 |
| Somewhat satisfied | 40 | 40.4 |
| Very satisfied | 44 | 44.4 |
| **Total** | **99** | **100** |
4. DISCUSSION

In this study, the retail pharmacies practitioners' perspectives on the implementation of Malaria Rapid Diagnostic Test was sought and decisions analyzed in themes, using Realist Conceptual Approach. In line with some studies in Uganda [21] this research considered private retail pharmacies as an important source of medical treatment for communities. The study was primarily powered to determine the willingness and acceptability to implement MRDTs at retail private pharmacies. The responses from practitioners were consistent with concept of realistic approach as stated earlier in the introduction. The results established 96.03% of practitioners were well informed and aware of the deployment of the new technology through scientific conferences/workshops (70.3%). However, these had had little impact as less than one percent (0.99%) was found to have always used the test kit in this study. The seminar strategies appear to be generally ineffective and more imaginative as revealed in this study and thus sustainable approaches such as interactive training and routine supervision linked with monitoring and recognition of good practice would hugely scale up the implementation. Furthermore, practitioners' reluctant to implement was established in this study as 44% and 40% were very satisfied and somewhat satisfied respectively with presumptive diagnosis as against 1% and 10% who were very dissatisfied and somewhat dissatisfied respectively. This satisfactory posture emphasizing presumptive treatment has become a real challenge to the implementation. The practitioners like those in public sector as seen in a study by Chandler et al [22], were holding a long established mindset of presumptive treatment that has been hard to leave behind. Effective educational and regulatory policy to practitioners must be embarked upon for smooth scale up of the policy.

Some other factors were established militating against the implementation of the new technology. Firstly, 39.6% of practitioners considered affordability [23] and convenience at their premise as a real challenge. Affordability in terms of cost components in private retail pharmacy is a driving factor for patronage. Introducing the new technology has a tendency to increase cost of treatment and could have repercussion on profit margin. A potential increase in profit margins has had some impact on drug shop practitioners [24]. Diagnostic testing was deemed useful in theory, to satisfy curiosity for more information about an illness. However, this curiosity waned in the face of potential cost involved, especially under the scenario where the test does not confirm syndromic diagnosis, when the purchase of antimalarials was more appealing. For the new policy to be highly successful, it should be packaged to entail incentives in the form of subsidies to practitioners and/or proprietors of private retail pharmacies. The structural designs of and the brisk commercial nature of retail pharmacy in Ghana has made convenience of space and time as identified in this study a critical factor in implementing MRDTs. Incorporating MRDTs in this private sector will require significant restructuring of premises.

Secondly, 21.8% of practitioners identified both ‘not very sure of the sensitivity and specificity of the test’ and ‘not sure of regular supply and storage of test kit as challenges. Several studies though, have proved MRDTs potential in sensitivity and specificity and more clearly delineate non-malaria febrile illnesses, and argued that this would improve management of such cases [1,25-28]. In this study, the practitioners were mindful of the fact that there is significant variation between and within products, suggesting variation in manufacturing quality [29]. Addressing these problems of selecting and quality controlling MRDTs down to the point of care remains one of the main challenges facing their successful use [30,31]. These could lead to false results due to poor sensitivity and specificity which could undermine the confidence of practitioners and lead to non-adherence to the new
treatment guidelines. In the light of these possibilities, more emphasizes should be based on the good manufacturing practices. The supply chain and storage challenges were derived from the usual stock out syndromes in pharmaceutical practice and not a very good storage environment in private pharmacies in Ghana. For large-scale deployment particularly in Africa, the stability up to 40 degree celsius is highly recommended for storage condition [32].

Thirdly, 12.9% of practitioners thought that cultural, religious and traditional beliefs in using blood during the process would be problematic. In traditional African society, drawing of blood in any circumstance could trigger rumours that could impede adherence [33]. A similar suggestion by caregivers that blood test is for HIV/AIDS and not malaria have been reported also in Uganda and Tanzania [34,35]. It is important, therefore, effective counseling is encouraged to dismantle the stigma associated to that perception.

Finally, of the practitioners 2.9% considered always training of new staff on the use of test kits as a challenge. A very few proportion of practitioners considered that, and this could suggest that handling the test kits is very simple and does not need much technicalities.

Ultimate pragmatism of patients accepting the new technology as perceived by the practitioners [(36.6%, very sure and 44.5%, somewhat sure)] in this study indicated ‘systematized thinking’ [36]. This assumption by the practitioners could be based on the fact that many patients frequently visit the drug shops as the first (often only) source of treatment, because they are numerous, easily accessible and more oriented to satisfying consumer needs as established in studies by Nankabirwa et al and Ndyomugyenyi et al. [37,38].

Practitioners agreement to implement [(47.52%, strongly agree, 48.51%, agree)] and suggest to colleague [(60.39%, definitely, 33.66% probably) with Chi-squared value of 0.000 and Likelihood Ratio of 0.006, p≤0.05] lend strong support (because of significant relationship) to the viability for test uptake at private retail pharmacies in Ghana. This finding could mean that MRDTs is easier to perform and to interpret, yielding fast results, and despite the variations observed in performance, their sensitivity remains higher compared to microscopy. The MRDT is cost-effective for management of correctly diagnosed malaria compared to microscopy and presumptive treatment [39, 40], indicating that implementation at retail pharmacies will be helpful for malaria diagnosis.

5. CONCLUSION

The findings contribute to the body of evidence on the willingness to implement the new policy of MRDTs, but with identifiable challenges, at private retail pharmacies. The evidence provides an opportunity for adaptation of a conceptual framework leading to the uptake of the policy. However, optimal acceptance of the new policy required Information, Education and Communication, IEC, designed to fit into local context. This is because presumptive diagnosis is still the practice three years in the deployment of the policy. MRDTs hold great promise and very cardinal in rational use of medicines within the biomedical paradigm of diagnostic-based treatment.

CONSENT

Practitioners consent was sought and answering the questionnaire was voluntary and privacy of their answers, facilities and themselves were guaranteed.
ETHICAL APPROVAL

The study was reviewed and cleared by institutional review and ethics committee at the Department of Clinical and Social Pharmacy, KNUST, Ghana.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. D’Acremont V, Lengeler C, Mshinda H, Mtasiwa D, Tanner M, Genton B. Time to move from presumptive malaria treatment to laboratory-confirmed diagnosis and treatment in African children with fever. PLoS Medicine. 2009;6(1):252. doi: 10.1371/journal.pmed.0050252.
2. Hammer DH, Ndhlouv M, Zurovac D, Fox M, Yeboah-Antwi K, Chanda P, et al. Improved diagnostic testing and malaria treatment practices in Zambia. Journal of the American Medical Association. 2007;297(20):2227-31. PMID: 17519412.
3. Ibrahim SM. Decisive assessment of diagnostic staining methods of malaria in eight public and private laboratories. Khartoum Area; TDR/EMRO Final Report Summary. 1996;1995-2000.
4. Ngasala B, Mubi M, Warsame M, Petzold MG, Massele AY, Gustafsson LL, et al. Impact of training in clinical and microscopy diagnosis of childhood malaria on antimalarial drug prescription and health outcome at primary health care level in Tanzania: a randomized controlled trial. Malaria Journal. 2008;7(1):199. doi:10.1186/1475-2875-7-199.
5. Bell D, Go R, Miguel C, Walker J, Cacal L, Saul A. Diagnosis of malaria in a remote area of the Philippines: comparison of techniques and their acceptance by health workers and the community. Bulletin of the World Health Organization. 2001;79(10):933-41. PMCID: PMC2566678.
6. D’Acremont V, Malila A, Swai N, Tillya R, Kahama – Maro J, Lengeler C, Genton B. Withholding antimalarials in febrile children who have negative results for a rapid diagnostic test. Clin Infest Dis. 2010;51:506–11. doi: 10.1086/655688.
7. World Health Organization. WHO: World malaria report. Geneva; 2008.
8. Murray CJL, Rosenfeld LC, Lim SS, Andrews KG, Foreman KJ, Haring D, Fullman N, Naghavi M, Lopez AD. Global malaria mortality between 1980 and 2010: a systemic analysis. Lancet. 2012;379:413-431. doi:10.1016/S0140-6736(12)60034-8.
9. Moon S, Perez Casas C, Kindermans J, de Smet M, Von Schoen-Angerer T. Focusing on quality patient care in the new global subsidy for malaria medicines. PLoS Medicine. 2009;6(7):1000106. doi: 10.1371/journal.pmed.1000106.
10. Rauf, et al. Randomized trial evaluating the impact of MRDT at the Community retail pharmacies in Ghana, 2013. unpublished.
11. Barat L, Chipipa J, Kolczak M, Sukwa T. Does the availability of blood slide microscopy for malaria at health centres improve the management of persons with fever in Zambia? Hyg Am J Trop Med. 1999;60:1024-30. PMID: 10403337.
12. Naing CM, Gatton ML. Performance appraisal of rapid on-site malaria diagnosis (ICT malaria Pf/P_test) in relation to human resources at village level in Myanmar. Acta Trop. 2002;81:13-9.
13. Rakotonirina H, Barnadas C, Raherijafy R, Andrianantenaina H, Ratsimbasoa A, Randrianasolo L, Jahevitra M, Andriantsionirina V, Menard D. Accuracy and reliability of malaria diagnostic techniques for guiding febrile outpatient treatment in malaria-endemic countries. Am J Trop Med Hyg. 2008;78:217–21. PMID: 18256418.

14. Sharew B, Legesse M, Animut A, Jima D, Medhin GBE. Evaluation of the performance of CareStart TM Malaria Pf/Pv Combo and Paracheck Pf® tests for the diagnosis of malaria in Wondo Genet, Southern Ethiopia. Acta Trop. 2009;111:321-4. doi: 10.1016/j.actatropica.2009.05.014.

15. Gerstl S, Dunkley S, Muktar A, Smet M, Baker S, Maikere J. Assessment of two malaria rapid diagnostic tests in children under five years of age, with follow up of false-positive p-LDH test results, in hyperendemic falciparum malaria area, Sierra Leone. Malar J. 2010;9:28. doi:10.1186/1475-2875-9-28.

16. Uzochukwu BSC, Onwujekwe OE, Uguru NP, Ughasoro MD, Ezeoke OP. Willingness to pay for rapid diagnostic tests for the diagnosis and treatment of malaria in southeast Nigeria: ex post and ex ante. Int J Equity Health. 2010;9:1. doi: 10.1186/1475-9276-9-1.

17. Pawson R, Greenhalgh T, Harvey G, Walshe K. Realist review – a new method of systematic review designed for complex policy interventions. J Health Serv Res. 2005;19(1):21-34. PMID:16053581.

18. Greenhalgh T, Peacock R. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. BMJ. 2005;331:1064. doi: http://dx.doi.org/10.1136/bmj.38636.593461.68.

19. Regional Pharmacy Council, Ashanti Region. Secretariat report; 2013.

20. Norman G, Monteiro S, Salama S. Sample size calculations: should the emperor’s clothes be off the peg or made to measure? BMJ. 2012;345:5278. doi: 10.1136/bmj.e5278.

21. Adome RO, Whyte SR, Hardon A. Popular pills: Community drug use in Uganda, Amsterdam. Het Spinhuis. 1996;112.

22. Chandler CI, Whitty CJ, Ansah EK. How can malaria rapid diagnostic tests achieve their potential? A qualitative study of a trial at health facilities in Ghana. Malar J. 2010;9:95. doi: 10.1186/1475-2875-9-95.

23. Hansen et al. The cost influence usage of Malaria Rapid Diagnostic Test; 2009. unpublished

24. Labhardt ND, Manga E, Ndam M, Balo JR, Bischoff A, Stoll B. Early assessment of the implementation of a national programme for the prevention of mother-to-child transmission of HIV in Cameroon and the effects of staff training: a survey in 70 rural health care facilities. Tropical Medicine & International Health. 2009;14(3):288-93. doi: 10.1111/j.1365-3156.2009.02221.x.

25. Mselleum MI, Martensson A, Rottlant G, Bhattarai A, Stromberg J, Kahigwa E, et al. Influence of rapid malaria diagnostic tests on treatment and health outcome in fever patients, Zanzibar: a crossover validation study. PLoS Medicine. 2009;6(4):1000070. doi: 10.1371/journal.pmed.1000070.

26. Moody A. Rapid diagnostic tests for malaria parasites. Clin Microbiol Rev. 2002;15:66-78. doi: 10.1128/CMR.15.1.66-78.2002.

27. Murray CK, Bell D, Gasser RA, Wongsrichanalai C. Rapid diagnostic testing for malaria. Trop Med Int Health. 2003;8:876-83. PMID: 14516298.

28. Perkins MD, Bell DR. Working without a blindfold: the critical role of diagnostics in malaria control. Malar J. 2008;7(1):5. doi: 10.1186/1475-2875-7-S1-S5.

29. Murray CK, Gasser RA Jr, Magill AJ, Miller RS. Update on diagnostic testing for malaria. Clin Microbiol Rev. 2008;21:97-110. doi: 10.1128/CMR.00035-07.
30. Bell D, Wongsrichanalai C, Barnwell JW. Ensuring quality and access for malaria diagnosis: how can it be achieved? Nat Rev Microbiol. 2006;4:682-95. doi:10.1038/nrmicro1474.
31. WHO. Update of WHO procedures for selection and use of quality malaria RDTs. Geneva: World Health Organization; 2008. Available: http://www.wpro.who.int/sites/rdt/who_rdt_evaluation/call_for_testing.htm.
32. Chiiodini PL, Bowers K, Jorgensen P, Barnwell JW, Glady KK, Luchavez J, et al. The heat stability of Plasmodium lactate dehydrogenase-based and histidine-rich protein 2-based malaria rapid diagnostic tests. Trans R Trop Med Hyg. 2007;101:331-7. PMID: 17212967.
33. Mbonye AK, Ndyomugyenyi R, Turinde A, Magnussen P, Clarke S, et al. The feasibility of introducing rapid diagnostic tests for malaria in drug shops in Uganda. Malar J. 2010;9:367. doi:10.1186/1475-2875-9-367.
34. McMorrow ML, Masanja MI, Abdulla SM, Kahigwa E, Kachur SP. Challenges in routine implementation and quality control of rapid diagnostic tests for malaria, Rufiji District, Tanzania. Am J Trop Med Hyg. 2008;79:385-90. PMID: 18784230.
35. Williams HA, Causer L, Metta E, Malila A, O'Reilly T, et al. Dispensary level pilot implementation of rapid diagnostic tests: an evaluation of RDT acceptance and usage by providers and patients – Tanzania, 2005. Malar J. 2008;7:239. doi:10.1186/1475-2875-7-239.
36. Young, A. Some implications of medical beliefs and practices for social anthropology. American Anthropologist. 1976;78(1):5-24. doi: 10.1525/aa.1976.78.1.02a00020.
37. Nankabirwa J, Zurovac D, Njogu JN, Rwakimari JB, Counihan H, Snow RW, Tibenderana JK. Malaria misdiagnosis in Uganda – Implications for policy change. Malar J. 2009;8:66–8. doi:10.1186/1475-2875-8-66.
38. Ndyomugyenyi R, Magnussen P, Clarke S. Diagnosis and treatment of malaria in peripheral health facilities in Uganda: findings from an area of low transmission in South – Western Uganda. Malar J. 2007;6:39. doi:10.1186/1475-2875-6-39.
39. Bisoffi Z, Sirima BS, Angheben A, Lodesani C, Gobbi F, Tinto H, et al. Rapid malaria diagnostic tests vs. clinical management of malaria in rural Burkina Faso: safety and effect on clinical decisions. A Randomized Trial Tropical Medicine & International Health. 2009;14(5):491–8. doi: 10.1111/j.1365-3156.2009.02246.x.
40. Chanda P, Castillo-Riquelme M, Masiyi F. Cost effectiveness analysis of the available strategies for diagnosing malaria in outpatient clinics in Zambia. Cost Eff Resource Alloc. 2009;8:5. doi: 10.1186/1478-7547-7-5.

© 2014 Rauf et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?id=440&id=14&aid=3890