*Annals of Tropical Paediatrics* (2005) 25, 91–100

# Community effectiveness of malaria treatment in Uganda—a long way to Abuja targets

JESCA NSUNGWA-SABIITI*†‡¶, GÖRAN TOMSON¶**, GEORGE PARIYO†, JASPER OGWAL-OKENG*§ & STEFAN PETERSON†¶

**Department of Pharmacology & Therapeutics and †Institute of Public Health, Makerere University, ‡Child Health Division, Ministry of Health, Kampala and §Faculty of Medicine, Gulu University, Uganda, and ¶Department of Public Health Sciences, International Health **Medical Management Center, Karolinska Institute, Stockholm, Sweden*

(Accepted March 2005)

**Abstract**

*Introduction*: At the Roll Back Malaria summit for African countries in Abuja, the heads of state committed to ensure that by the year 2005 at least 60% of those suffering from malaria would have access to effective treatment within 24 hours of onset of symptoms.

*Aim*: The aim of the study was to assess community effectiveness of malaria treatment in children.

*Method*: A community-based survey of 500 households was undertaken in western Uganda.

*Results*: A total of 260 (52%) children were reported to have had fever within the previous 2 weeks: 87% received some kind of treatment, 44% were said to have been treated within 24 hours of onset of symptoms, 47% received appropriate anti-malarials, 25% received the correct dosage, and 24% took the drug for the recommended period of time; altogether, only 7% received all the treatment steps.

*Conclusion*: With drug efficacies of 50–90%, we estimate a community effectiveness of 4–6%, which is far from the 2005 Abuja target. The greatest need for improvement in the Home Based Fever Management strategy is in reducing delay in treatment and improving dosage and duration of treatment.

## Introduction

In sub-Saharan Africa where most malaria is caused by *Plasmodium falciparum* that can cause death within a short time,[1] early and effective treatment is the mainstay of preventing childhood death from malaria.[2] The success of malaria treatment depends not only on the efficacy of drugs but also on a sequence of steps that carers of sick children have to take to ensure effective treatment and cure.[3] Only when all these steps are carefully followed in sick children (use of an appropriate and effective anti-malarial within 24 hours of onset of illness in an adequate dose and for the correct duration) will they be cured and optimal community effectiveness of treatment achieved.[4–6] The Roll Back Malaria (RBM) campaign provides a unique opportunity to improve community effectiveness of malaria treatment. At the RBM summit for African countries in Abuja, heads of state made a commitment to ensure that by the year 2005 at least 60% of those suffering from malaria would have access to appropriate treatment within 24 hours of onset of symptoms.[7] Less than 1 year away from the stated target, information on the community effectiveness of treatment is lacking.

Although neither theoretical drug efficacy nor appropriate use can lead on its own to the final goal of community effectiveness,

Reprint requests to: Dr Jesca Nsungwa-Sabiiti, Child Health Division, Ministry of Health, PO Box 12536, Kampala, Uganda. Fax: +256 41 287167; e-mail: jsabiiti@infocom.co.ug


DOI: 10.1179/146532805X45683

most of the current debate on improving effective malaria treatment has focussed on the urgent need to introduce more efficacious, artemisinin-based combination therapies;[8,9] drug use practice has received less attention.

Against a background of weak health systems in most endemic countries, treatment-seeking studies clearly demonstrate that most malaria cases are self-treated at home.[10–13] Following promising trials in Ethiopia, the Home Based Fever Management (HBM) Strategy is being promoted to attain the Abuja target.[14] HBM aims to treat all under-5 fever incidents by bringing antimalarial drugs of good quality in pre-packed, unit-dose form to villages and homes. Uganda adopted this strategy in April 2002 for gradual scale-up in the country.[15,16] At the same time, Uganda changed its policy for first-line antimalarials from chloroquine (CQ) monotherapy to combination treatment with chloroquine and sulphadoxine–pyrimethamine.[17] Although The Ministry of Health communicated this policy change to the various districts, there was no widespread publicity. Promotion of the new drug policy was expected to use HBM as a vehicle. Hopes are high that HBM will be widely taken up and achieve community effectiveness. However, community effectiveness of malaria treatment before HBM was implemented is not known.

Several authors have reported on individual treatment steps with regard to community effectiveness.[10,18–20] Krause reported on several steps leading to community effectiveness of health facility-based malaria treatment.[21] Amin *et al.* included home and community treatment but disregarded compliance aspects in studying community effectiveness of malaria treatment in Kenya.[22] For a true reflection of community effectiveness, however, all treatment steps, whether at home, in pharmacies or in health facilities, need to be considered.[3,4,23]

Before HBM was implemented, we conducted a study in a rural setting in Uganda to evaluate each of the different steps to community effectiveness under HBM and assess the cumulative compliance rate taking all the previous steps into account.

## Subjects and Methods

A cross-sectional survey was conducted in August 2002 at the end of the rainy season in rural Kasese which has a population of approximately 532,993. It is a mountainous district (altitude 1200–1700 m) where there is great variability in malaria transmission. Endemicity ranges from meso- to hyperendemic as one moves from high altitudes to the lowlands. The infant mortality rate is estimated to be 103/1000 and malaria accounts for 23% of outpatient diagnosis in children.[24] There are three hospitals and 60 health centres. As well as from formal health care providers, anti-malarial drugs can be obtained from non-regulated providers including small shops which stock basic household items and dispense drugs without prescription. Private clinics are found mainly in the trading centres. The Ministry of Health targeted Kasese for early implementation of HBM; by the time of this study, however, HBM had not yet been introduced.

### *Sampling*

The study population consisted of three sub-counties in Kasese (each with approximately 16,000 people), selected because they had been targeted for the forthcoming HBM intervention. A minimum sample size of 473 subjects was calculated at the outset, assuming 30% fever prevalence in the under-5s with 5% absolute precision. Using a census list, 27 village clusters were randomly sampled proportional to size from three sub-counties. From each village, 18 households were then randomly selected. For logistical and statistical reasons, households were selected by dividing each village into four geographical quadrants using natural boundaries.[23] One quadrant was

randomly sampled using a simple ballot paper method. Village leaders listed and numbered sequentially all households with children <5 years old in the selected village quadrant. This list was verified against the existing household list in the local village council registers.

Study households were sampled from the list using random tables. In each household, a caregiver with primary responsibility for the child, preferably the mother, was eligible for the interview if she gave consent. Children of non-resident caretakers were ineligible. A household was defined as all persons living under one roof who prepare and eat meals together. Accordingly, a polygamous household might consist of two or three families living under one roof with the same head of household. Given that this study was to evaluate practices regarding management of fever rather than malaria morbidity, in households with more than two eligible children, the youngest was chosen because the higher incidence of malaria in younger children would mean a higher likelihood of being able to establish practices in a recent incidence of malaria.

*Data collection*

A structured, closed-ended questionnaire with key illness terms translated into the local language was used. Nine non-medical, experienced interviewers, male and female, were trained over a 3-day period in enquiry technique and participated in pre-testing the questionnaire in three villages not included in the final study. An experienced researcher supervised each of the three field teams (first author and two medical officers). Each interviewer administered questionnaires separately (guided by local field guides) in the local Rukonzo language. Each interview lasted 45 minutes on average.

The first part of the questionnaire concerned socio-demographic factors, geographical access to drug treatment, knowledge of national policy guidelines for treatment of childhood malaria and whether the index child had fever 2 weeks before the study.[25,26] A widely known term validated in previous studies, *omusutsa*, was used for fever.[27]

The second part of the questionnaire was administered only to mothers who reported recent fever in their child and it included detailed descriptions of symptoms, place and type of treatment and how the medicine was administered. To obtain a complete history, caregivers were repeatedly prompted on what else they did. Using an open-ended questionnaire, all respondents were finally interviewed about how access to prompt and correct treatment for fever might be improved.

Timeliness of treatment referred to the interval between first noticing symptoms and starting treatment. It was considered that an anti-malarial drug had been administered if the mother mentioned the name of a specific anti-malarial drug. The interviewers then verified and differentiated these from common antipyretics, using samples of brands available. Some mothers showed samples of the drugs to the interviewer. 'Home treatment' was defined as any treatment given prior to or instead of going to a health care provider in either a public or private clinic. This included traditional remedies such as herbs and modern drugs kept in the home or obtained from a community drug vendor or pharmacy where medication can be obtained without prescription.

A child was considered to have been "treated effectively" if the caretaker reported that the last fever episode had been treated within 24 hours with the appropriate anti-malarial of a given efficacy, in an adequate, age-specific dose, and for the correct duration. For each child, appropriateness of dose and duration was assessed during analysis by comparison with national treatment guidelines.[15] The information on effective drug use was then combined with estimates of drug efficacy. Two measures were calculated: first, for each of the steps, the proportion of children who complied and then the cumulative proportion of compliant children for all five elements.

The change in malaria drug policy from CQ to combination CQ+SP preceded fieldwork for this study by only 3 months and was meant to be disseminated and driven by the HBM intervention. Since this had not yet been implemented in the study area, to analyse community effectiveness we defined 'appropriate anti-malarial' as CQ, the previous first-line treatment or combination CQ+SP, as recommended in the new policy.

*Data entry, quality control and analysis*

Data were double-entered and the two datasets checked for discrepancies using Epi data 3.0 and Epi Info version 6.04 (CDC, Atlanta). Using Stata version 8.0, the proportion of children who complied with the five steps defined for community effectiveness was calculated, followed by a calculation of community effectiveness according to Krause, by assuming independence between treatment steps and multiplying the proportions by each other.[21] Home treatment *vs* treatment in a health facility was the main stratifying variable. Two-by-two tables were constructed and odds ratios with 95% confidence limits for the adjusted odds ratios applied.

*Ethical considerations*

Participation was voluntary and informed verbal consent was obtained from heads of households (when available) and primary caregivers in the home. The study was approved by Makerere Medical School research committee and the ethical committee of The Karolinska Institute (D-nr 03-259). Approval was also obtained from Kasese district administration office and village council leaders.

## Results

*Socio-demographic characteristics*

A total of 500 caregivers were enrolled and complete questionnaire information was available for 498 cases. Nearly all respondents were female (93%), mothers (90%) of the enrolled children. The few male respondents (37/489) were all fathers of the enrolled children. The median age of the interviewees was 29.8 years (range 13–76), 65% of whom had received primary and 7% post-primary education; 28% had had no formal education.

The median age of the study children was 24.1 months (range 1–59) and 47% (234/498) were <2 years of age. Fifty-one per cent of them were girls.

*Access to treatment*

The median distance from the study households to the nearest source of treatment was a 30-minute walk. Ninety-five per cent of treatment sources mentioned provided modern medicine: 42% were public clinics, 21% ordinary shops, 17% private clinics and 13% community drug distributors (CDDs) or vendors. One-tenth (9.3%) reported using treatment already in the home. Compared with other sources of treatment, CDDs were more likely to be within a 30-minute walk of the home (OR 2.5, 95% CI 1.1–5.6).

*Caregivers' knowledge of main cause of malaria and first-line drug policy (Table 1)*

The majority mentioned mosquitoes as the main cause of fever. Only eight (2%) mentioned combination CQ+SP as first-line

TABLE 1. *Caregivers' knowledge of cause and treatment of malaria,* n=*498.*

| Knowledge | No. (%)† |
|---|---|
| Mosquito as a cause | 428 (86) |
| Correct first-line anti-malarial drug* | 348 (71) |
| Correct dosage of CQ | 92 (19) |
| Correct duration of CQ treatment | 69 (14) |

* Mention of CQ, SP or combination CQ+SP; † row percentages.

treatment for malaria. Almost a fifth of caregivers stated the correct CQ dose for a 3-year-old child or duration of treatment. In addition, 42% stated that it was important to complete the prescribed treatment.

*Prevalence of fever*

Of 498 children, 260 (52%) were reported to have had fever (*omusutsa*) in the 2 weeks before the survey. At the time of the survey, median duration of reported ill health was 3 days, with 60% being ill for <5 days. There was no significant gender difference in fever morbidity.

*Health care-seeking behaviour*

A total of 224 (87%) children with a history of fever were reported to have received treatment for it before the survey. Of these, 46% (104/224) were first self-treated at home and 36% were taken to a public and 17% to a private clinic. In 43% of cases, the treatment given to the child was bought in an ordinary shop or from a drug vendor, or was medicine already in the home.

Although more non-educated than educated mothers tended to treat fever at home, the difference was not statistically significant. Caregivers who mentioned living within a 30-minute walk of a CDD were more likely to seek treatment from a CDD than to use other sources (OR 5.0, 95% CI 2.6–9.5).

TABLE 2. *Time to initiating treatment after onset of fever,* n=*260.*

| Time to initiating treatment | No. (%)[†] |
|---|---|
| Same day (<24 hrs) | 113 (44) |
| Next day | 66 (25) |
| After 2 days | 16 (6) |
| Other[⋆] | 65 (25) |
| Total | 260 (100) |

⋆ Not known or no treatment; [†] column percentages.

*Community effectiveness of fever treatment*

Six elements were studied for community effectiveness: coverage of children treated, timeliness of treatment, choice of antimalarial drug, correct drug dosage and duration of treatment. Completeness of information for each element ranged from 96 to 100%. The sixth element, drug efficacy, was estimated from other studies.[28,29]

*Treatment of febrile children.* Of the 260 children who had had fever in the previous 2 weeks, caregivers reported different treatment actions being taken for 224 children (87%). Most of these had received modern or herbal treatment, as outlined below, while 5% reported only supportive treatment such as cooling the child with a wet cloth or a cold bath.

*Time between onset of illness and initiation of treatment* (Table 2). A total of 224 children were reported to have received treatment. Median duration between onset of illness and treatment was 35 hours (range 3 h–10 d). More than half (56%) the children with fever were either not treated or received treatment 24 hours after onset of illness. Those with fever who lived near a CDD and those reported to have been treated at home started treatment earlier than others (OR 2.1, 95% CI 1.1–4.1 and OR 2.6, 95% CI 1.6–4.2, respectively). Educated mothers were more likely than non-educated ones

TABLE 3. *Types of drugs said to be used to manage fever in children,* n=*260.*

| Type of medication | No. (%)[¶] |
|---|---|
| Antipyretics[⋆] | 75 (29) |
| Antimalarial[†] | 129 (50) |
| Antibiotics[‡] | 7 (3) |
| Herbal | 21 (8) |
| Other[§] | 9 (4) |
| None | 13 (5) |
| Don't know | 10 (4) |

⋆ Paracetamol & aspirin; [†] includes CQ, SP, CQ+SP, quinine & primaquine; [‡] includes cotrimoxazole, penicillin, metronidazole & chloramphenicol; [§] includes ORS, sulphadimidine & mebendazole; [¶] row percentages.

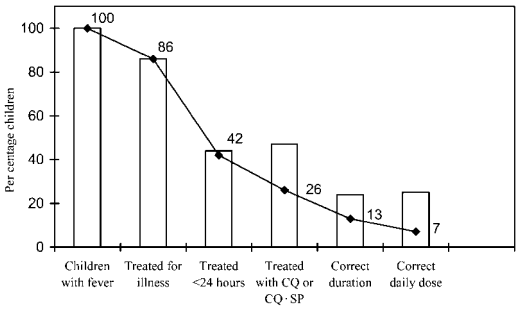


FIG. 1. Percentage of 260 children with fever receiving effective treatment and % effectiveness of each treatment step; —◆—, % cumulative observed effectiveness.

to initiate treatment early (OR 1.6, CI 1.0–2.7).

*Choice of drug to treat fever* (Table 3). Half of the 260 children were treated with an anti-malarial drug. Chloroquine (CQ) was the most commonly used (46%). Only six children (2%), all >3 years of age, were treated with combination CQ+SP therapy. Other anti-malarial drugs used included quinine and primaquine, often used as multiple therapies. Of the 260 children, seven received antibiotics and 21 herbal remedies. Children living near a health facility were more likely to be treated with an anti-malarial than those living near another source of treatment (OR 1.7, 95% CI 1.1–3.3).

*Treatment duration and daily dosages.* Children were treated for a mean duration of 3.3 days (range 1–7) and 41% were treated for <3 days. Only 65 (25%) were given the correct daily dose of CQ or combination CQ+SP.

*Effectiveness of each treatment step and combined community effectiveness* (Table 4 & Fig. 1). Of the 260 children reported to have had fever, 224 received treatment, 113 of them within 24 hours. Only 7% were adequately treated. Combining this with a CQ drug efficacy of 90% gives an overall community effectiveness of 6%, or, in the case of a lower efficacy of around 50%, the community effectiveness would be 4%.

The estimated community effectiveness in the fourth column of Table 4, assuming independence between treatment steps, is calculated according to Krause *et al.*[21] Multiplying the estimated cumulative effectiveness with the measured effectiveness of each subsequent treatment gives an estimated community effectiveness of 1%.

*Community's perceptions on improving prompt and correct treatment of fever.* Most caregivers (62%) regarded formal health services as cumbersome and not easily accessible at all times. They thought it a waste of time going to health facilities only to be asked to buy prescribed medication when others were out of stock. Fifteen per cent thought that the number of health facilities in the village should be increased, 37% suggested that drugs should be distributed by health workers or trained volunteers in the village and 15% proposed that

TABLE 4. *Proportions of effective steps and estimated overall community effectiveness of malaria treatment,* n=*260.*

| Treatment step | Effectiveness of each step, *n*=260 (%) | Observed community effectiveness, *n*=260 (%) | Estimated community effectiveness (%)† |
|---|---|---|---|
| Children with fever: | 260 (100) | 260 (100) | |
| Treated for illness | 224 (86) | 224 (86) | 86 |
| Treated <24 hrs* | 113 (44) | 108 (42) | 86×44=38 |
| Treated with CQ or CQ+SP | 123 (47) | 67 (26) | 38×47=18 |
| Correct duration | 64 (24) | 34 (13) | 18×24=4 |
| Correct daily dose | 65 (25) | 17 (7) | 12×25=1 |
| CQ drug efficacy‡ | 90% | 15 (6) | 7×90=1 |

* Any treatment, including tepid sponging, herbal, etc.; † multiplicative estimate based on effectiveness of each treatment step;[21] ‡ data on drug efficacy from the literature.[28,29]

drugs be stocked by mothers in the home for treating fevers promptly. On how to ensure that caregivers adhere to instructions for administering drugs, including completion of medication, 11% suggested a need to educate mothers or make drugs less bitter, and 1.4% either did not know or gave no response.

## Discussion

In this survey conducted in a rural setting, we demonstrated very low overall community effectiveness of malaria treatment (7%) compared with the 2005 Abuja target of 60%. Krause *et al.* demonstrated similar findings based on multiple datasets at health facility level using a seven-step treatment model.[21] They calculated a 3% community effectiveness of malaria treatment started in public health facilities in Burkina Faso. However, there are two main differences between their approach and ours. First, since 'self treatment' for malaria in the home was 46% in this study and up to 80% has been reported elsewhere,[13] we believe that, to be representative, estimates of community effectiveness need to be community-based, as in this study and the Kenya study by Amin *et al.*[22] Second, reflecting the different treatment steps in the same rather than separate datasets allows observation of community effectiveness rather than estimation through multiplication (Table 4). The difference is striking. The effectiveness of the drug use practices observed was almost six times the estimate (6% *vs* 1%), which suggests that there might be a subset of more knowledgeable caregivers who perform well on several treatment steps.

This study highlights the difference in contribution towards overall effectiveness of treatment between the efficacy of the drug and the way it is used. While drug efficacies can range from 50 to 90%,[28–30] the effectiveness of current drug use practices is only 7%, implying that if timely and rational use of drugs for malaria is not adhered to, introducing new, more effective drugs will increase effectiveness by only a very small percentage (Fig. 1). Future debate on improved management of malaria would therefore benefit from addressing not only the choice of drug but, more urgently, the way they are used.

Looking at the different treatment elements, most practices were below expected standards, especially the interval before treatment was initiated, the dosage and treatment being given for sub-therapeutic duration, suggesting problems with treatment given at home and by health facilities. Delayed treatment and low drug compliance have been reported by others.[12,31,32] Reasons include lack of knowledge of how to treat fever[33] and complex local perceptions regarding childhood fever.[34] The Home Management of Malaria strategy might well improve these treatment steps since it does bring appropriate drugs closer to the home in age-specific blister packs which improves compliance with duration of treatment.[18]

Significant differences between levels of education were noted for treatment practices and likelihood of initiating treatment early. Such socio-economic differences have been reported elsewhere and might actually become more pronounced when new interventions are introduced and first adopted by higher socio-economic groups.[35] It remains to be seen which socio-economic groups first use the Home Management of Malaria intervention.

Contrary to other reports,[10] home treatment in this study was associated with earlier initiation of treatment for fever. This might be explained by the fact that children treated at home were more likely to be treated by CDDs who were more likely to be within a 30-minute walk of the child's home.

Difficulty of access as a cause of delayed treatment has been postulated.[36] In this study, apart from CDDs, geographical access to treatment based on walking

distance did not contribute significantly to length of interval between fever onset and initiating treatment. This suggests that there are other important factors to consider in providing effective treatment. Even with the introduction of HBM, as shown in other studies,[37,38] there is a need to strengthen health facilities to ensure that referred cases of severe malaria receive quality care.

There was almost no mention of combination CQ + SP therapy for treating fever, as nationally recommended. Only 2% of children were reported to have received this treatment. Given that HBM is supposed to serve as a vehicle for the new policy, this finding is not surprising because at the time of the study the CQ/SP combination had not been implemented.

Interviews with caregivers and other opinion leaders in the community indicated a lack of confidence in public health facility-based services and more enthusiasm for treating fever at community level. This concurs with Kilian[39] who observed in Uganda a high degree of acceptability of home treatment of malaria using pre-packaged anti-malarials.

This study takes a symptom-based approach, focusing on fever as a symptom of malaria. Given the ambiguity of fever,[27] it was not possible to distinguish malarial fever from other common fevers. However, this is no different from standard, presumptive treatment of malaria in health facilities. The study was based on caregivers' recall and reporting of actions rather than observation. The estimate of community effectiveness can therefore only be as accurate as the caregivers' memories. Choosing the youngest child in households where there was more than one eligible child might have introduced an age bias, which could have increased recognition of illness and prompt treatment but possibly decreased dose and compliance. Our inclusion of CQ as an 'appropriate anti-malarial' was determined by the low penetration of information about the change in drug policy in the few months preceding the survey. This study was conducted in a rural setting and might not be applicable to more urban or less mountainous areas because of possible local variations in fever diagnosis and access to drugs from clinics or shops.

Also, we did not disaggregate treatment practice by socio-economic group or other factors limiting effective treatment. While the Abuja target is demanding and there might be no harm if treatment is delayed by 24 hours or prescribed dosages are not entirely adhered to, our aim was to evaluate the malaria programme objective of anti-malarial treatment given within 24 hours of onset of illness in the correct dosage and for the correct duration for all fevers.

The study highlights a large gap between current community effectiveness of malaria treatment and the Abuja target levels. The current debate on improving malaria treatment stresses the change of malaria drug policy; the results of this study suggest a need also to give high priority to improving how drugs are used. The most important improvements needed are in reducing delay in treating fever and using the correct dosages for the correct period of time, which could have a significant impact on overall drug resistance. Our findings support the urgency of improving treatment of malaria in the community. Although this study shows that the situation in Kasese undoubtedly needs to be improved, the fact that nearly 50% of caregivers treat fevers within 48 hours is encouraging. The impact of HBM on community effectiveness needs to be evaluated, including identifying uptake and drug use by different socio-economic groups.

## Acknowledgments

We thank the population of Kasese district, the enumerators, the district health team for assistance in implementing the study, The Ministry of Health, WHO Uganda and The Karolinska Institute/IHCAR for technical support and encouragement. We also thank

Drs Senyonjo, Kakumba and Balyeku who co-supervised the fieldwork. The study was funded by the Sida/SAREC–Makerere University Collaboration Programme.

## References


1 Greenwood BM, Bradley AK, Greenwood AM, *et al.* Mortality and morbidity from malaria among children in a rural area of The Gambia, West Africa. *Trans R Soc Trop Med Hyg* 1987; **81**:478–86.

2 World Health Organisation. *A Global Strategy for Malaria Control.* WHO: Geneva, 1993.

3 Tugwell P, Bennet K, Sackett DL, Haynes RB. The measurement iterative loop: a framework for the critical appraisal of need, benefits and costs of health interventions. *J Chronic Dis* 1985; **38**:339–51.

4 Tanner M, Lengeler C, Lorenz N. Case studies from the biomedical and health systems research activities of the Swiss Tropical Institute in Africa. *Trans R Soc Trop Med Hyg* 1993; **87**:518–23.

5 Mumba M, Visschedijk J, van Cleeff M, Hausman B. A Piot model to analyse case management in malaria control programmes. *Trop Med Int Health* 2003; **8**:544–51.

6 Buve A, Changalucha J, Mayaud P, *et al.* How many patients with sexually transmitted infections are cured by health care services? A study from Mwanza region, Tanzania. *Trop Med Int Health* 2001; **6**:971–9.

7 WHO/CDS/RBM. The Abuja declaration on Roll Back Malaria in Africa by the African heads of state and governments. Abuja: Nigeria, 2000.

8 Attaran A, Barnes KI, Curtis C, *et al.* WHO, the Global Fund, and medical malpractice in malaria treatment. *Lancet* 2004; **363**:237–40.

9 Watkins B, Kokwaro G, Galinski M, Mutabingwa TK, Trape JF. WHO, the Global Fund, and medical malpractice in malaria treatment. *Lancet* 2004; **363**:1161–2.

10 Lubanga RG, Norman S, Ewbank D, Karamagi C. Maternal diagnosis and treatment of children's fever in an endemic malaria zone of Uganda: implications for the malaria control programme. *Acta Trop* 1997; **68**:53–64.

11 McCombie SC. Self-treatment for malaria: the evidence and methodological issues. *Health Pol Plan* 2002; **17**:333–44.

12 Deming MS, Gayibor A, Murphy K, Jones TS, Karsa T. Home treatment of febrile children with antimalarial drugs in Togo. *Bull WHO* 1989; **67**:695–700.

13 Bremen J. The ears of a hippopotamus: manifestations, determinanats and estimates of the malaria burden. *Am J Trop Med Hyg* 2001; **64**:1–11.

14 World Health Organisation. Report from joint RBM/TDR meeting on scaling up Home Management of malaria. Geneva: WHO/TDR, 2002.

15 Ministry of Health, Uganda. *Uganda Home Based Fever Management Strategy*. Kampala: Ministry of Health, 2002.

16 Wendo C. Uganda leads the way on Africa Malaria Day. *Lancet* 2002; **359**:1494.

17 Ministry of Health, Uganda. *Uganda Malaria Control Program five year strategic plan,* 2000–5. Kampala: Ministry of Health, 2000.

18 Sirima SB, Konate A, Tiono AB, Convelbo N, Cousens S, Pagnoni F. Early treatment of childhood fevers with pre-packaged antimalarial drugs in the home reduces severe malaria morbidity in Burkina Faso. *Trop Med Int Health* 2003; **8**:133–9.

19 Salako LA, Brieger WR, Afolabi BM, *et al.* Treatment of childhood fevers and other illnesses in three rural Nigerian communities. *J Trop Pediatr* 2001; **47**:230–8.

20 Pagnoni F, Conveldo N, Tiendrebeorgo J, Cousens S, Esposito F. A community-based programme to provide prompt and adequate treatment of presumptive malaria in children. *Trans R Soc Trop Med Hyg* 1997; **91**:512–17.

21 Krause G, Sauerborn R. Comprehensive community effectiveness of health care. A study of malaria treatment in children and adults in rural Burkina Faso. *Ann Trop Paediatr* 2000; **20**:273–82.

22 Amin AA, Marsh V, Noor AM, Ochola SA, Snow RW. The use of formal and informal curative services in the management of paediatric fevers in four districts in Kenya. *Trop Med Int Health* 2003; **8**:1143–52.

23 Turner AG, Magnani RJ, Shuaib M. A not quite as quick but much cleaner alternative to the Expanded Programme on Immunization (EPI) Cluster Survey design. *Int J Epidemiol* 1996; **25**:198–203.

24 Ministry of Health, Uganda. *Health Information System*. Kampala: Ministry of Health, 2001.

25 Harrison LH, Moursi S, Guinena AH, *et al.* Maternal reporting of acute respiratory infection in Egypt. *Int J Epidemiol* 1995; **24**:1058–63.

26 Ross DA, Huttly SR, Dollimore N, Binka FN. Measurement of the frequency and severity of childhood acute respiratory infections through household surveys in northern Ghana. *Int J Epidemiol* 1994; **23**:608–16.

27 Nsungwa JS, Kallander K, Nsabagasani X, *et al.* Local fever illness classifications: implications for home management of malaria strategies. *Trop Med Int Health* 2004; **9**:1191–9.

28 Kamya MR, Bakyaita NN, Talisuna AO, Were WM, Staedke SG. Increasing antimalarial drug resistance in Uganda and revision of the national drug policy. *Trop Med Int Health* 2002; **7**:1031–41.

29 Ndyomugenyi R, Magnussen P, Clarke S. The efficacy of chloroquine, sulfadoxine pyrimethamine and combination of both for the treatment of

uncomplicated *Plasmodium falciparum* malaria in areas of low transmission in western Uganda. *Trop Med Int Health* 2004; **9**:47–52.

30 Checchi F, Piola P, Kosack C, *et al.* Antimalarial efficacy of sulfadoxine–pyrimethamine, amodiaquine and a combination of chloroquine plus sulfadoxine–pyrimethamine in Bundi Bugyo, western Uganda. *Trop Med Int Health* 2004; **9**: 445–50.

31 Fawole OI, Onadeko MO. Knowledge and home management of malaria fever by mothers and caregivers of under five children. *West Afr J Med* 2001; **20**:152–7.

32 Agyepong IA, Ansah E, Gyapong M, Adjei S, Barnish G, Evans D. Strategies to improve adherence to recommended chloroquine treatment regimes: a quasi-experiment in the context of integrated primary health care delivery in Ghana. *Soc Sci Med* 2002; **55**:2215–26.

33 Baume C, Helitzer D, Kachur SP. Patterns of care for childhood malaria in Zambia. *Soc Sci Med* 2000; **51**:1491–503.

34 Hausmann-Muela S. *Community Understanding of Malaria, and Treatment-seeking Behaviour, in a Holoendemic Area of Southeastern Tanzania.* PhD thesis, University of Basel, 2000.

35 Victora CG, Wagstaff A, Schellenberg JA, Gwatkin D, Claeson M, Habicht JP. Applying an equity lens to child health and mortality: more of the same is not enough. *Lancet* 2003; **362**:233–41.

36 Wakgari D, Ali A, Enqusellasie F. Self treatment of malaria in rural communities, Butajira, southern Ethiopia. *Bull WHO* 2003; **81**:261–8.

37 Peterson S, Nsungwa-Sabiiti J, Were W, *et al.* Coping with paediatric referral—Uganda parents' experience. *Lancet* 2004; **363**:1955–6.

38 Simoes EA, Peterson S, Gamatie Y, *et al.* Management of severely ill children at first-level health facilities in sub-Saharan Africa when referral is difficult. *Bull WHO* 2003; **81**:522–31.

39 Kilian AH, Tindyebwa D, Gulck T, *et al.* Attitude of women in Western Uganda towards pre-packed unit dose malaria treatment for children. *Trop Med Int Health* 2003; **8**:431–8.