LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

PROJECT REPORT

CANDIDATE NUMBER: *471720*

MSc Public Health in Developing Countries

PROJECT TITLE

WHERE DO CHILDREN WITH FEVER SEEK TREATMENT? A REVIEW OF SOCIO-ECONOMIC DISPARITIES IN SEEKING OF FEVER TREATMENT IN 20 MALARIA ENDEMIC COUNTRIES IN SUB-SAHARAN AFRICA

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WORD COUNT: 9947

Project Length: *Standard*

Submitted in part fulfilment of the requirements for the degree of MSc in Public Health in developing Countries

FOR ACADEMIC YEAR 2007-2008

Submitted on: 2nd September 2008

ABSTRACT

Background: In sub-Saharan Africa, malaria is number one killer of children under five years. Deliveries of proven malaria interventions depend on already over burdened and fragile health systems in Africa. In order to achieve the United Nations Millennium Development Goals and/or Roll back Malaria targets of reducing under five mortality its vital that the existing health systems are strengthened and alternate intervention delivery strategies are introduced especially that target the young children from poor families. This study aims to evaluate treatment seeking and therefore access to existing anti-malarial drug delivery systems in sub-Saharan Africa by children with fever and assess socio-economic disparities in this treatment seeking behaviour. This will inform policy makers and programme managers at national and sub-national levels on designing alternative drug delivery strategies for Artemisinin-based Combination Therapies (ACTs) to ensure that they reach disadvantaged populations.

Methods: Data was compiled from 21 recent nationally-representative household surveys on fever prevalence and treatment seeking from malaria endemic countries in Africa. Using asset-based wealth index (proxy to socio-economic status) and concentration index (CI) (measure of disparities), socio-economic disparities in treatment seeking for children who had fever two weeks prior to the survey from the various health delivery points were examined.

Results: Of the children who had fever two weeks prior to the surveys, 59.4% (InterQuartile range (IQR), 51.3% - 65.4%) reported seeking treatment with children from the least poor households were more likely to seek treatment; median CI (0.067(IQR, 0.037 to 0.090). Public health and private medical sectors showed a pro-rich treatment seeking (overall median CI, 0.096(0.060, 0.157) and 0.335 (0.143, 0.405) while retail and community-based sectors showed a pro-poor treatment seeking; overall median CI -0.033(-0.045, 0.043) and -0.120(-0.194, -0.029) respectively. However, there were considerable regional and country variations in treatment seeking patterns and socio-economic disparities in the surveyed countries.

Conclusion: There is need for reviewing malaria control policies with a view of targeting the children from poor households. The retail-markets and community-based intervention delivery strategies need to be explored further as possible channels of providing ACTs to the poor in the malaria endemic countries.

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ACKNOWLEDGEMENTS

Sincere appreciation goes to all who helped in the execution of the project and especially my supervisor, Jayne Webster, whose technical input and guidance is enormously appreciated. Many thanks also to my tutors, Tom Marshal and Jane Bruce, for their unlimited support and guidance in my studies as well as in the conduct of the project. Their statistical acumen was well harnessed in the entire project. Input from Lucy Smith requires a special mention. Her experience in handling the household survey data was important to my understanding of the analysis.

Macro International granted permission for use of the demographic and health surveys and malaria indicator survey data for this project. Last but not least; I would like to acknowledge the Commonwealth Scholarship Commission for funding my studies, in LSHTM, and in particular for supporting me during the conduct of this project.

1.0 INTRODUCTION

1.1: Malaria Burden in Africa

Globally, malaria poses an enormous public health problem with an estimated 40% of the world's population living in areas of malaria risk. It is estimated that 300 – 500 million malaria cases and at least 1 million malaria deaths occur annually[1]. The spatial distribution of malaria is mainly in the tropical areas and in resource poor countries especially in Africa [2]. In areas of stable malaria transmission in sub-Saharan Africa (SSA), malaria is the main cause of morbidity and mortality in young children. Recent analyses confirm that malaria is a principal cause of at least 20% of all young child deaths in Africa, which accounts for 90% of all malaria deaths globally[1 3-5]. The latest available data on outpatient visits and on hospital admissions and deaths due to malaria confirm that this disease makes substantial demands on Africa's fragile health infrastructure. In endemic countries, as many as one-third of all clinic visits and at least a quarter of all hospital admissions are for malaria. In some countries, these data suggest that illness due to malaria has increased over the past decade; in others, the size of the problem has remained constant[1]. The huge burden of disease poses a big challenge as well as a strain on already over burdened and weak health systems across SSA[6]. This calls for concerted efforts to strengthen the existing health systems and establishment of novel delivery strategies of the proven malaria interventions especially targeted to the young children – who are most vulnerable.

1.2: International Response on Malaria Control

There has been an outstanding increase in the global response to combating malaria in Africa. The last decade has seen the emergence of more financing opportunities for malaria interventions and research[7]. Notably, the launch of the Roll Back Malaria (RBM) Partnership in 1998 has been key in setting the benchmarks for establishing targets and monitoring progress in the fight against malaria [8].

The RBM Partnership global aim of reducing the burden of malaria by 50% by 2010 has since been endorsed by United Nations (UN) in the Millennium Development Goals (MDGs). The UN general Assembly has declared 2001 to 2010 the "decade To Roll Back Malaria" especially in SSA *(UN general assembly, resolution 55/284)* which signifies the high priority given to fighting malaria. In an historic meeting held in Abuja, Nigeria, the African heads of state and government expressed their commitment to control of malaria by signing the Abuja declaration in 2000. A number of targets were set as a result, mirroring the specific RBM technical strategies. Of interest to this report, is the target to ensure that by 2005, 60% of individuals suffering from malaria should have access to and be able to use correct, affordable, and appropriate treatment within 24 hours[9] - to coincide with RBM technical strategy on prompt access to effective malaria treatment[10], discussed later.

The three of the proven interventions to combat malaria in Africa are; residual/indoor spraying with insecticides; use of insecticide-treated bed nets; and early diagnosis and effective treatment of those with symptoms. More money has been devoted to scaling up these interventions across malaria risk areas. It is in this pretext, that during a recent conference hosted by Bill and Mellinda Gates foundation, the agenda of eradication of malaria was reintroduced [11]. Further the feasibility of such a goal is a focus for current debates. Though such an (long-term) agenda is welcome, there is a pressing need to ensure prompt access to effective malaria treatment to the children less than five years, the most vulnerable, in SSA if the mortality reduction goals set by RBM partners and/or the UN MDGs are to be realised. It is in this light that this study focuses on reviewing the most recent household-level data, to provide the much needed evidence on access to treatment by socio-economic status (SES) particularly in the young African children. This broad analysis will provide data which will be useful for strategic planning, for administrators and programme managers are interested in indicators of access that would allow them to assess quickly how communities compare on access, or determine whether a particular health services delivery strategy has an improved access

to the target population. Programmes may then build on one or more interventions with known effectiveness and combine them into delivery strategies designed to reach high, sustained, and equitable coverage, at adequate levels of quality, in all who need the interventions.

In the last few years there have been changes of national malaria drug policies in most of countries in malaria risk areas in Africa, mostly from Chloroquine to Sulfadoxine-pyrimethamine and now to Artemisinin-based Combination Therapies (ACTs). Malaria parasites, in particular *Plasmodium falciparum,* developed resistance to these earlier anti-malarial drugs necessitating the changes. Currently, WHO recommends ACTs as the first-line drugs for treatment of malaria. The complexity of ACT dosing and more so, the high cost of these drugs necessitated discussions of a "Global ACT Subsidy" from the World Bank. The ACT subsidy concept has since been endorsed by the RBM Partners with creation of Affordable Medicines Facility of Malaria (AmFm) task force in early 2007. RBM support the AMFm as a mechanism for making effective anti-malarial drugs available to countries that need them at an affordable price[12] and hence could be seen as an effort to ensure the poor have access to this life-saving malaria treatment. Access to anti-malarial drugs, especially ACTs, by the poor in rural African settings is complex, and alternative innovative delivery strategies need to be assessed. There is limited literature in this area, especially which arises from malaria prone areas of Africa. This project attempts to use available data to assess the access to the existing anti-malarial drug delivery systems/strategies as well as exploring any socio-economic (SE) disparities in access via each of these systems/strategies.

1.3: Health Systems and Anti-Malarial Drug Delivery Strategies

To a great extent the performance of health systems is reflected in the various indices of health, for example in neonatal and under five mortality rates. In the case of malaria, one of the proven interventions relies almost entirely on a functioning health system. The care system should provide

quick diagnosis of malaria and rapid access to effective medications to treat it. The prompt access to effective treatment can determine whether the child lives or dies. There are diverse health care delivery systems in SSA. The public health system, which is funded and/or run by the governments' Ministry of Health in many African countries, provides subsidized services. A very active, large, diverse and to a great extend unregulated, private medical sector also exists. The private sector is made up of independent medical practitioners, religious institutions, NGO-run facilities, pharmaceutical vendors and shopkeepers. It has been reported that on average 46% of all doctors in Africa work in the private sector [13]. Even the poorest households are just as likely to go to private providers as to public facilities for healthcare[13 14]. Almost half of all health care costs are paid for out-of-pocket at the time a person seeks care[15]. Studies show that high out-of-pocket medical expenses can force the sick and their families into (further) poverty[16].

In addition to the health sectors, described above, Africa has long standing traditional practice ranging from spiritual healers to herbalists[17]. These too play a role in malaria treatment and understanding the use of their services can help in understanding treatment seeking patterns and hence inform policy makers on appropriate strategies to reach their clients.

Malaria control interventions and especially treatment are provided mainly through the public and private health sectors. In SSA, anti-malarial drug delivery strategies include provision through public and private medical health facilities as well as retail sector (private pharmacies, drug vendors, and shopkeepers)[6]. Community-based strategies through community health workers and community pharmacies are in place in some countries, a god example being in Uganda[18] Introduction of ACTs in most African countries, which is currently confined to prescription-only distribution in the public health sector in many malaria endemic countries of Africa, limits the available options of delivery to the population. A combination of drug delivery strategies might be required to reach all vulnerable populations. It is critical, for policy makers, in the context of the changing national malarial control

policies to understand where people seek treatment when they have clinical symptoms of malaria - emphasis here on fever.

1.4: Prompt Access to Effective Malaria Treatment

Fever is regarded as the most common symptom of uncomplicated malaria disease. Due to high malaria prevalence and severity among young children, fever has been considered as a sufficient trigger for presumptive treatment of children with anti-malarial drugs in most malaria endemic settings in Africa [19 20]. It is worth noting the diagnostic reliance on fever alone, is associated with high diagnostic sensitivity but poor specificity[21]. Other acute infections like acute respiratory tract infections are also associated with fever and frequently occur in the same settings and age groups (in SSA). The RBM partnership promotes prompt, effective treatment of fevers as a key strategy for achieving its optimistic mortality reduction goals. RBM hopes to ensure that 80% of children receive effective anti-malarial drugs within 24 hours of fever onset[8 22].

1.5: Socio-Economic Disparities in Malaria

As alluded to earlier, malaria cases and deaths are most highly concentrated in resource poor countries of Africa. However, it is unclear whether the poorer groups within countries experience more malaria. It is known that they face worse consequences in terms of mortality and severe illness[23]. Access to malaria treatment is very variable across SSA, and especially so by SES. An analysis of household survey data from the early 1990s by Filmer *et al* suggested lack of access to treatment among the poorest was greater in west and central Africa and that over 70% of the lowest two quintiles lack access to treatment in west and central Africa relative to about 45% in South and east Africa[24]. There are indications that all SE groups have some access to treatment but the proportion from poorer groups getting treatment tends to be lower than the better off. The treatment

quality (more effective anti-malarial, adequate dosage) is biased to the advantage of the better off. All SE seem to use the private medical and public sectors, but this is more common in the better off.

There is some evidence suggesting people who are not receiving services(malaria interventions) are disproportionately from poorer households[23 25-29]. The public health system is the main focus of delivery of prompt and effective malaria treatment – however, we know that public health care services reach the poorest households only at very high coverage, for example coverage of Expanded Programme of Immunisation [29].

In order to achieve universal prompt access (or meet established targets) to effective malaria treatment (ACTs) in SSA, the need for alternative drug delivery strategies has since been recognized[30-32]. In the context of efforts on scaling up access to treatment, delivery strategies that reach children from poor households, especially those in the rural settings, become increasingly important. There are debates on the best strategies for delivery of anti-malaria drugs especially to the poor and the most vulnerable groups in remote settings. Provision of subsidized ACTs through community health workers and shops/kiosks has been suggested as an equitable means of improving access[33]. It is thus essential to assess treatment seeking (access) at these alternative delivery points, by young children with fever, who are at greatest risk of the severe consequences of malaria and thus in most need of prompt and effective treatment. Treatment seeking is an objective measure of realized access to services provided by public health facilities, private medical centres, retail sector (pharmacies/shops) and community-based approaches. An understanding of where people seek treatment and of examination of SE disparities in this treatment seeking is essential in strategic planning for improving access to ACTs. Such data can also be pivotal in assessing alternative ACT delivery strategies and ways of strengthening the existing ones in view of reaching those in most need, that is, young children from poor families. Functioning, equitable, sustainable and effective

health delivery strategies are a prerequisite to achieving health-related MDGs and/or the RBM targets.

2.0 AIM AND OBJECTIVES

The overarching aims of this study is to evaluate treatment seeking, and therefore access to existing anti-malarial drug delivery systems in SSA by children with fever and explore any SE disparities in this treatment seeking behaviour. This will inform policy makers and programme managers at national and sub-national levels on designing alternative drug delivery strategies for ACTs, to ensure that they reach disadvantaged populations, children from poor households especially in remote settings. The specific objectives are:

i) To assess SE disparities in occurrence of fever in children under five years old in malaria endemic countries in Africa.

ii) To find out where children under five years with fever seek treatment, and assess any SE disparities in treatment seeking.

iii) To compare the SE disparities in treatment seeking at the public health sector relative to other health delivery systems/strategies across the surveyed countries.

iv) To examine the level of treatment seeking for traditional practices in provision of fever treatment in under fives in SSA.

3.0 MATERIALS AND METHODS

3.1 The Survey Data

The data arise from the available Demographic and Health Surveys (DHS) and Malaria Indicator Surveys (MIS) from 20 SSA countries whose surveys were carried out between 2003 and July 2008. The DHS are nationally-representative, household surveys that are routinely undertaken in many developing countries. They cover a wide variety of demographic and health indicators on fertility,

family planning, maternal and child health, child survival, HIV/AIDS, nutrition and of interest here malaria. In most countries, between 5,000 and 10,000 women in their reproductive age (aged 15 to 49 years) are interviewed about their own health and that of their children. The MIS are similar to DHS in many respects except the fact that they are restricted to the data on malaria. The surveys are designed to produce data that are comparable over time and across countries. For this study, analysis is restricted to data on children less than five years who had fever in two weeks preceding the day of the survey. The surveys collect data on whether, and where advice and/or treatment for the fever was sought and this constitutes the data specifically used in this analysis. The data sets (DHS or MIS) were extracted from Macro international website (*http://www.measuredhs.com*). Recent data was considered important due to the dynamic nature of fever management in the context of the changing national malaria control policies.

3.2: Statistical Analysis

Data from each country was checked for completeness and quality through (cross) tabulation and graphical methods. Data management involved generating new variables that were based on the following definitions of where the caretaker reported they sought advice or treatment of fever for his/her child(ren). For the purposes of this analysis the place where the advice or treatment was sought were classified as illustrated in *figure 1***.** Briefly, the possible delivery points of conventional anti-malarial treatment were classified as “formal” health system or all sectors. This consisted of four different sectors, namely; *public, private medical, retail and community-based sectors*. The public health sector consisted of government-run health facilities such as hospitals, health centres, dispensaries, government pharmacies and mobile clinics while private medical sector referred to private hospitals and clinics, faith-based hospitals and clinics, and Non-Governmental health facilities. Shops, private pharmacies, mobile drug sellers/vendors constituted the retail sector. The community-based sector included community health workers, rescue agents (Chad), community

pharmacies, family and friends and any unspecified places of care referred to as “others” in the DHS/MIS datasets – this was in an effort to improve sensitivity which was considered essential for this study. Each of the four sectors was assumed to represent a specific possible anti-malarial drug delivery system/strategy.

The coverage of each possible anti-malarial drug delivery system/strategy was calculated as the proportion of children aged less than five years who had fever in the two weeks preceding the survey who sought advice/fever treatment from the facilities constituting the respective delivery sector. Coverage was used as a measure of treatment seeking at a delivery point where fever treatment is dispensed; it does not necessary include a measure of whether (effective) treatment was received. Since there was no adequate data across the countries about where fever treatment was sought first (the survey question asks for places where treatment was sought), an individual child could have more than one point of care and hence the assigned the sectors were not mutually exclusive. It was checked, though not reported in detail whether the children got medication if they sought treatment in any of the above delivery points. It is also important at this point to note the computed coverage by delivery strategy did not take into consideration the promptness in seeking care nor the effectiveness of the drugs received. This was partly due to lack of adequate data across the countries to compute such a statistic as well as to minimise information biases (reporting, recall and interviewer biases) that could be associated with getting such data in surveys. Given the aim of this study it was considered more appropriate to use the computed treatment seeking rather than introducing more assumptions on patterns of seeking care that is, the timeliness and effectiveness of received drugs.

Treatment seeking from traditional practice was also calculated. This included those who sought advice or fever treatment from traditional healers, spiritual healers and/or herbalist.

In order to assess any SE disparities in reported fever prevalence and treatment seeking via each possible drug delivery strategies, asset-based wealth indices were used. The World Bank has developed a tool to measure relative economic position of households. Data on a range of household assets, availability of electricity, housing characteristics, water supply and sanitation facilities is used to compute an index of economic status using Principal Component Analysis by which households are ranked and divided into wealth quintiles[34]. In developing countries, the assets that households have acquired are a good indicator of their 'long-run' economic status and hence the wealth quintiles can be used as proxy measures of SES[35-37]. Wealth indices have also been validated against household expenditure data[36]. The concentration index (CI) was chosen as the measure of SE disparities in treatment seeking from various drug delivery systems because of two key reasons. First, CI provides a measure of disparity that is relatively independent of the overall level of treatment seeking (higher treatment seeking does not necessary entail less inequality). Second, other measures of inequalities such as equity ratio and equity difference compare treatment seeking in only the highest and lowest quintiles thereby excluding 60% of the data – the CI measures disparities across all the quintiles. CI is defined with reference to the concentration curve (*figure 2*) which graphs on the x-axis the cumulative percentage of the sample, ranked by SES, beginning with the least poor and on the y-axis the cumulative percentage of the treatment seeking from respective health sector corresponding to each cumulative percentage of the distribution of the wealth quintile. The CI is thus defined as twice the area between the concentration curve and the line of equality (the 45^0 line running from the bottom-left corner to the top-right). The index can take a positive value when the curve lies below the line of equality, indicating disproportionate concentration of the treatment seeking among the least poor(pro-rich treatment seeking) or negative values when it lies above the line of equality (pro-poor treatment seeking)[38 39]. Specific interpretation of the CI is based on the factor in question relating to whether it is an indicator of good or bad health.

The CI was computed from grouped survey data in a spreadsheet program using the following formula[40].

$$CI = (p_1L_2 - p_2L_1) + (p_2L_3 - p_3L_2) + \ldots + (p_{T-1}L_T - p_TL_{T-1}),$$

where p is the cumulative percent of the children in the Tth wealth quintile ranked from the most poor to the least poor and, L_T is the corresponding cumulative percentage of children who sought fever treatment from the specific sector in the Tth wealth group.

Variables used in this analysis were extracted from standard DHS or MIS datasets for each country. Stata Version 10 (STATA Corp) was used for data management, data checking and statistical analysis. Stata has a set of commands that allow for complex survey analysis which account for the survey design and can adjust for any clustering in the sampled populations. Appropriate estimates of treatment seeking by wealth quintile for each delivery system were obtained. Using the treatment seeking estimates the CIs were computed using the World Bank spreadsheet (based up on the formula by Kakwani *et al* for grouped data with no standard deviations)[41] and Stata was used to cross-check the results. Comparisons of SE disparities of treatment seeking between delivery systems were made using Wilcoxon signed rank test. Spearman's correlation coefficients were used to measure the relation between treatment seeking and SE inequalities. The nonparametric tests were used because the use of aggregated country data for the various delivery systems meant there was small numbers to compare and not expected to follow a normal distribution as well as the fact that the surveys included in the analysis weren't selected at random.

3.3: Ethical Approval

The DHS and MIS data sets are publicly available through Macro International upon request. Permission to use the dataset for this project was sought from Macro International and the study was approved by London School of Hygiene and Tropical Medicine ethical review committee.

4.0 FINDINGS

4.1: Fever Occurrence and SE Disparities

Data from 20 countries (20 DHS and 1 MIS), representing a total of 156, 972 children less than five years old was reviewed. Among the 21 surveys, the median (Inter Quartile Range (IQR) number of children involved was 7593(5088 to 9129). The range was between 3530 in Ghana and 9129 in Benin. The reported fever occurrence and associated SE disparities are presented in *Table 1 and Figure 3(i)*. Of the total children under five, 41,739 had fever in the two weeks preceding the survey. The overall median of reported fever prevalence (IQR) among the children surveyed was 26.8% (23.2% - 34.3%). The highest fever prevalence was reported in Uganda (40.9 %) with lowest in Zimbabwe (7.5%).

The reported fever occurrence was disproportionately higher in the poorest (children from the poorest households) compared to the least poor in 16 of the countries studied and significantly so in 9, which were Senegal(MIS), Guinea, Niger, Uganda, Tanzania, Malawi, Madagascar and Ethiopia. No survey indicated that the prevalence of fever was significantly higher amongst children from richer households. The overall median CI (IQR) of fever prevalence was -0.026(-0.048, -0.002). As shown in *Figure 3(i),* there was no evidence of association of SE disparities and prevalence of fever across the countries surveyed, Spearman's correlation coefficient, r=-0.23, p=0.3.

4.2: Treatment Seeking and SE Disparities

There was considerable variation in seeking of treatment for children who had fever across the countries by the various health sectors. Across the surveys, most of the children for whom treatment was sought in the "formal" health sectors (defined here as public sector, private sector, retail sector, and community based, excluding only traditional outlets and treatments) got drugs ranging from analgesics, anti-pyretics and anti-malarial. Since it was outside the scope this project, no further

analysis was done to check the effectiveness of the drugs received. Of the children who had fever, only 59.4% (IQR, 51.3% - 65.4%) sought care from the "formal" health sector – in Ethiopia only 18.8% (95% confidence interval; 15.8% – 21.9%) unlike in Tanzania 83.4% (95% confidence interval; 81.5% - 86.4%). No country had achieved the set RBM target of 80% by the time of the surveys. Tanzania and Uganda had 83.4% and 83.1% respectively of children for whom treatment was sought – it is unlikely that when promptness and effectiveness are added to the indicator – that this would remain above 80%.

Detailed data on treatment seeking and SE disparities are presented in *Tables 1 and 2 and Figures 3(ii) - (vi)*. The CI values indicating statistically significant pro-poor treatment seeking are underlined while pro-rich treatment seeking are in bold. The overall median of CI (IQR) was 0.067 (0.037, 0.090) indicating the SE disparities in "formal" health sector treatments seeking was to the advantage of children from richer households, but not hugely so. In most (14) countries, these SE inequalities were statistically significant but the extent to which this was true varied between countries. Socio-economic inequalities in treatment seeking were especially high in Benin, Ethiopia, Chad and Madagascar and rather high in Senegal (DHS), Mozambique, Niger, Nigeria, Zimbabwe, Congo Brazzaville and Guinea. They were lower in Cameroon, Kenya and Tanzania. The remaining surveys showed a pro-rich treatment seeking though not statistically significant.

Examining the treatment seeking from public sector relative to other sectors, treatment were sought for a higher proportion of children from public health facilities in most of the countries except for Chad, Malawi, Nigeria and Niger where the majority bought drugs from the retail sector. Uganda was the only country where the private medical facilities were reportedly utilized more than the any other sectors. The overall median (IQR) of treatment seeking from the public sector was 29.1% (24.2% – 32.6%) and for the retail sector was 18.0% (10.9% – 22.1%). The private medical sector

and community-based strategies were the least sought for fever treatment with overall median (IQR) of 5.0% (2.6% – 9.8%) and 3.9% (1.9% – 5.5%) respectively.

The public health sector characteristically served disproportionately children from the least poor households in most countries with an overall median CI (IQR) of 0.096(0.060 to 0.157). This pro-rich treatment seeking was statistically significant in all the surveyed countries except Ghana, Cameroon, Tanzania, Kenya, Rwanda and Madagascar. It is only in Uganda, where public health sector had a pro-poor treatment seeking and it was statistically significant. A similar pattern (pro-rich treatment seeking) was seen for the private medical sector; overall median (IQR) CI of 0.335(0.143 to 0.405).

The SE disparities in the retail sector treatment seeking had mixed results across the surveys; overall median CI (IQR) of -0.026(-0.045 to 0.049). Even though 14 countries showed an inclination towards pro-poor treatment seeking, it was only in Guinea, Burkina Faso, Kenya and Madagascar where this was statistically significant. Uganda, Zimbabwe, Rwanda, Mozambique and Ethiopia were the only countries depicting a pro-rich treatment seeking and the evidence was strong. Children from the poorer households were more likely to seek fever treatment from Community-based providers compared to their richer counterparts. This evidence was particularly strong for children surveyed in Senegal (MIS), Cameroon, Guinea, Burkina Faso, Benin, Malawi, Zimbabwe, Rwanda and Mozambique. It is only in one country, Niger, where the reverse was statistically significant but the numbers were particularly very small (15/2170). Thus its not surprising the overall median (IQR) CI for Community-based sector treatment seeking was -0.120 (-0.195 to -0.029).

4.3: Correlation of SE Disparities and Treatment Seeking

Comparing SE disparities of the private, retail and community-based sectors relative to public drug delivery strategies, clear differences were seen(*Table 3)*. There was a significant difference between

the overall median CIs for public and private medical delivery, p=0.001. Private medical delivery had greater pro-rich treatment seeking, depicted by a higher positive CI. On checking for regional variations, within the group of central and west African countries, the median CI for public drug delivery was significantly lower than the median for the private medical delivery(p=0.004). Though a similar pattern was seen for the east and southern African group the differences weren't significant, (p=0.1). In the 21 surveys it is only in Chad and Zimbabwe where the public sector delivery had a higher CI than that of private medical sector. There was also a significant difference between the overall median CIs for public and retail health delivery strategies, p=0.03. But on sub-regional checks, in central and west African countries the difference was highly significant with the retail delivery CI being lower (depicting lower SE disparity) than public health delivery, p=0.004; unlike in east and southern African countries, p=0.1. As earlier reported, the community-based drug delivery strategy showed a pro-poor treatment seeking with an overall median CI that was statistically different from that of public sector across studied countries(p=<0.001) as well as in the two sub-regions, p=0.02.

The correlation between SE disparities and treatment seeking from the various health sectors are shown in *figure 3*. Socio-economic inequalities decreased with increase in level of treatment seeking from "formal" health system, overall spearman correlation coefficient, r=-0.62, p=0.003.This correlation was significant for the east and southern Africa sub-region, r=-0.92, p=0.0005; but not for central and west African countries, r=-0.38, p=0.2. The SE disparities also decreased with increase in treatment seeking from the public and private medical sectors; r=-0.43, p=0.05 and r=-0.51, p=0.02. On stratifying by regions, this phenomenon was significant only in central and west African countries. No clear pattern of association between treatment seeking and SE disparities for the retail(r=-0.36, p=0.1) and community-based sectors (-0.05, p=0.8) was found.

As shown in *figure 4*, there was no association between treatment seeking from all sectors and public sector and the reported fever prevalence, r=0.31, p=0.2 and r=-0.03, p=0.9 respectively.

4.4: Treatment Seeking and SE Disparities: Traditional Practice

Treatment seeking from traditional practitioners was invariably low across the 20 countries, ***Table 2***. As expected, children from poorer households were more likely to consult the traditional practitioners when they had fever relative to their richer counterparts in most countries except Ethiopia and Uganda where the reverse was true - though not statistically significant. The pro-poor use of the traditional medicine was statistically significant in Burkina Faso, Cameroon, Chad, Kenya, Madagascar, Nigeria, Senegal (MIS), Mozambique, Guinea and Niger. It is not clear whether no children with fever reported consultation with the traditional practitioners or data wasn't collected in Tanzania.

5.0 DISCUSSION

This is the largest review of the recent (2003 to 2008) DHS and MIS datasets on reported fever occurrence and access to treatment among children under five in malaria endemic countries of Africa. Slightly over 150,000 children in 20 countries were surveyed with about 40,000 (26.8%) experiencing at least one episode of fever two weeks preceding the survey. The fever prevalence showed low disparities across the wealth quintiles but in 8 surveys where the disparities were significant it was invariably biased to the disadvantage of children from poorer households. These countries were Guinea, Madagascar, Malawi, Senegal (MIS), Tanzania, Uganda, Ethiopia and Niger. A study by Filmer *et al* in 2002 where DHS data from 29 surveys in 22 countries was analysed reported at regional level a positive but insignificant relationship between fever and household SES in west and central Africa countries. The relationship was significant for east and southern Africa countries (Madagascar excluded from analysis)[24]. The link between fever incidence and SES seems

to be intuitively plausible given the poor are more likely to live in less protective house structures and to sleep under a mosquito net[29]. It has been argued that catastrophic expenditures such as those associated with hospitalisation for severe or complicated malaria can potentially drive a household into(or further into) poverty[16]. This might suggest a reverse causality phenomenon. Thus elucidate the complex pathways between SES and fever in the malaria endemic countries in Africa, a long-term carefully planned observational study coupled with a monitoring of a whole host of interrelated factors would be required.

Of the children who had fever, there was a great variability across the countries in treatment seeking from various health sectors and associated SE disparities. The RBM target of ensuring that 80% of children less than five years old receive effective anti-malarial drugs within 24 hours of fever onset was yet to be achieved by the time of these surveys. Focusing on treatment seeking amongst all sectors, which could potentially distribute conventional medicine, a median treatment seeking of 59.1% (range 19% to 84%) was reported. Given that in this study promptness and effectiveness of the treatment received was not taken into account, it would be likely that the reported treatment seeking is an overestimate of the RBM core population indicator[42]. RBM has proposed a set of core population level indicators for prompt access to effective anti-malaria treatment as the "Proportion of children under five years old with fever in the two weeks prior to the survey who received anti-malarial treatment according to the national policy within 24 hours from onset of fever"[42]. This "one catches all" statistic has limitations[42] and its computations particularly from available household survey data poses a great difficult due to use of national malaria policies as the guide to defining an effective malaria treatment and related problems in implementation of the national malaria policies[43] in many SSA countries – further assumptions that are not necessary comparable across the surveyed countries are required if such a statistic was to be used. More so, the national drug policies have been dynamic for the last few years further limiting the comparability across countries where household

data was available. Interestingly there was a clear pattern in SE disparities with the children from richer households being more likely to seek fever treatment across all the countries surveyed. This evidence was strong in 14 surveys. Notably, SE disparities decreased with increase in treatment seeking especially for countries in east and southern African region.

One of the objectives of this study was to explore the role of the public sector in delivery of fever treatment. Many governments and institutions have frequently stressed the need for public sector facilities to provide health care to the poor and disadvantaged populations especially in the rural settings. In spite of treatment seeking in the public sector being higher than that of other sectors in most (14) of the countries, levels of treatment seeking were still low. Less than a third of the children with fever sought treatment for fever from this sector, overall median (IQR) of 29.1% (24.2 to 32.6%). Contrary to the identified need to reach the poor and disadvantaged, there were marked SE disparities across the countries to the disadvantage of the poorer children. For most (in 14 surveys) part, these SE inequalities were statistically significant. It was only in Uganda where there was a pro-poor treatment seeking from public sector and this was statistically significant. It was not surprising to find that treatment seeking from private medical sector was biased in favour of the richer households almost invariably across the countries. It is unclear what could be attributed to the regional variations. It has been previously shown the low SE inequalities exist at high coverage of public health care services for instance the expanded Programme of immunization in SSA[29].

Although the CI of community-based delivery strategy of fever treatment indicates a low level of SE disparity and in fact a slight leaning towards the poorer families, the level of coverage was very low(small numbers) and hence these results should be interpreted with caution. The implementation of the community-based approaches in delivery of fever treatment might not have been scaled-up during the times of these surveys and thus further analysis would be needed after national implementation of this alternative drug delivery approach. It is also important to note that the

categorisation of community-based strategy for this analysis included a broad range of points of care, for example friends and relatives. It could be argued that drugs from friends and relatives were acquired from the shops/pharmacies (retail) or were left over from a previous prescription from the medical facilities in public or private medical sectors. These limitations not withstanding, the comparability of the results across countries firmly indicates the reliability and to some extend the validity of the used categorisation and the results seen. Uganda was the first African country to adopt the WHO Home-based Fever Management strategy(HBM) aimed at improving prompt access(within 24 hours) to anti-malarial drugs for presumptive treatment of all fevers in children under five year, launched in June 2002[33 44 45]. Even so, the treatment seeking from the community-based sector in this study was not particularly high, (5.5%; 95% confidence Interval, 4.4% – 6.7 %). An evaluation of the HBM initiative in Uganda indicated limited effectiveness, (treatment within 24 hours of onset, with recommended anti-malarials in the right dosage) with an overall 10% improvement in community effectiveness of malaria treatment. The strategy had most success in reaching the richest quintile (50% use), with the levels of coverage across the poor, the lower four quintiles around 20 – 25% [46 47]. The low access of fever treatment in Uganda, seen in this analysis, could be partly attributed to the scale of implementation of the HBM approach. An underlying understanding of the causes of childhood febrile illnesses has also been reported as a major determinant in the pattern of seeking fever treatment in this particular setting[18]. There is limited literature on ACT delivery through the HBM strategy, but what there is suggest that its feasible and acceptable even with the adherence and compliance concerns – linked to malaria parasites developing resistance to the only most effective anti-malarial drugs[48 49].

Interestingly, the retail sector had lower SE disparities in treatment seeking relative to the other sectors. This underlines the power of free markets in delivery of health care. The retail sector, providing what is commonly referred to as the Over-The-Counter (OTC) medicines, has previously

been understated in malaria control. Most of the countries included in this survey have adopted ACT as the first-line treatment for malaria. However, the supply of ACT is currently confined to prescription-only distribution in most of these countries through the public sector. This limits the available options of the delivery of the drugs to those in most need and effectively excludes equitable delivery strategies such as the shopkeepers, pharmacies and drug vendors, and possibly community health workers. It is been shown that OTC Medicine are the first source of treatment for febrile illnesses in young children[50 51]. Training of the private medicine retailers on malaria management (symptoms, recommended drugs and dosages) can improve access to effective treatment in time (within 24 hours). Following training of drug retailers in rural Kenya, there was an increase in the proportion of those purchasing anti-malarials who bought an adequate dose from 8% to 33%[51]. This active and highly accessible retail market provides opportunities for improving the access to effective anti-malarial treatment[52].

The reported low use of public health sector among children with fever and the associated SE disparities can be partly attributed to the weaknesses in provision of and demand for fever treatment, a consequence of malfunctioning health systems. Alternative strategies for delivery of anti-malarial drugs and ways of strengthening the existing systems deserves more consideration[53]. Traditional practices continue to take place in SSA and is generally sought more by the poorest as shown here and elsewhere[27 54 55]. Consulting with traditional healers could delay the access to effective malaria treatment and thus exacerbation of the disease – resulting to poor outcome. This suggest more work on health education and promotion tailored to recognising the early symptoms and the effective treatment options are still required in most of malaria risk areas in Africa. These disparities in seeking treatment could be one of the drawbacks to the current fight against malaria in Africa. It could be argued that improving access to timely, effective treatment should be biased to the advantage of the poor and all targets/goals should be reviewed in that effect – vertical equity.

Further understanding and interpretations of the findings requires critical appraisal of the study limitations and possible biases. First, the use of the asset-based indices in examining SE disparities within countries and more so across countries poses a considerable challenge. This is because of existence of great heterogeneinity in markers of wealth within and across countries, for example assets vary from rural and urban settings. The differences are more diverse across countries and the households that might constitute the poorest wealth quintile in Benin might be very different from those in Madagascar for instance. Hence the comparison of SE disparities across countries and contexts should be done with caution for the wealth quintile gives relative rather than absolute measure of poverty and wealth. Second, household survey data is subject to selection and/or information biases e.g. reporter bias, recall bias and interviewer bias. There is evidence that people from the richer groups report higher levels of illness than the poor. This bias in self-reporting of illness would result in underestimation of the SE disparities in fever occurrence and possibly on treatment seeking at the various health delivery points[56]. The magnitude and direction to which recall bias affects the results from these household surveys is not clear but there is no indication there would be any differential misclassification with respect to SES or a certain health sector(s). Third, there is a possible bi-directional causality between poverty and malaria - leading to bias of overestimation in the strength of the relationship between fever prevalence and SES. Forth, the comparison of the various providers of fever treatment is difficult due to inadequate information about the relative quality levels of care provided by different providers and timeliness of seeking treatment – quality of care and promptness in seeking treatment are crucial to having a good outcome in malaria treatment. Lastly, despite adjusting for the survey design in all the analysis in this study, there could be possible confounding factors to the reported SE disparities in treatment seeking such as the level of education of the caretakers (mothers), distance to health facilities[57] – which weren't explored. Whilst acknowledging the above limitations, the possible biases and possible confounders do not seem to reconcile the findings observed. The SE disparities of the various health delivery

strategies, in particular the characteristic pro-rich treatment seeking of the public sector and private medical sector and the pro-poor treatment seeking of retail and community-based sectors, can not be explicitly be attributed to the above biases or confounding.

As shown here and in a review by Webster *et al* on equity of mosquito bed-net and immunisation coverage, nationally representative household surveys "..can be a powerful tool for comparing the performance of different intervention's delivery systems"[29]. They can show which delivery strategies are reaching the poor though such surveys are used to monitor progress towards international targets. This monitoring is a key task at the global level, but for administrators and programme managers at national and sub-national levels information about the relative performance (in reaching the target populations) of the local delivery systems is more valuable. One of the major policy questions at the moment in implementation of malaria interventions relates to alternative delivery strategies and scaling-up delivery though the existing health systems of the proven interventions especially insecticide treated mosquito nets (ITNs) and presumptive fever treatment. Efforts to strengthen the existing public care systems in SSA have been supported by Global Fund for Malaria, Tuberculosis and HIV/AIDS among other donors. Even though this can go along way towards achieving the RBM goals and/or the MDGs, a critical evaluation of the performance of the existing health sectors, as provided in this study, is essential for such policy decisions. Given the increased concern in reducing under-five mortality especially associated with malaria, alternative channels of anti-malarial drug delivery should be considered. Evidence from this study, suggest that delivery through the retail and community-based systems can potentially reach the most vulnerable and disadvantaged populations in most of malaria endemic countries of Africa. Consequently, there is a need to spend resources in research and on improving delivery through the retail sector and developing delivery through community based systems. Further work is still required to learn from community based distribution

approaches including how to expand and sustain the system, how to make it cost effective and how to ensure it reaches the poorer households[46]

It is proposed that the alternative anti-malarial drug delivery strategies should be subjected to same rigorous effectiveness and cost-effectiveness assessments, as the drug clinical trials themselves, with a conceptual framework and research designs that will yield results with known generalisability. The choice of drug delivery strategy(ies) should consider malaria epidemiological patterns, existing health systems and cultural contexts if the goal of high, sustained and equitable access to effective malaria treatment is to be achieved[58]. In addition to strengthening the existing health systems, more effort should be devoted to changing key behaviours related to febrile illness treatment practices at family and community level.

Many questions remain about how different delivery mechanisms reach different population groups, and how best to reach the poor with effective interventions. Addressing these inequalities should be a priority for future research too. Interventions implemented in ways that will make it more likely to reach the poor should be promoted. Health messages and media for the Information and Education Campaigns efforts need to target to poor audiences. Provider training in retail sector needs to cover the types of providers that poor use. ACT distribution (accessible) through the types of outlets and delivery systems that the poor use and at price levels that are affordable to majority population as well as packaging that are easily understood by poor users and their providers. This shift in priority and policy setting need also to be accompanied by operational research of the alternative delivery systems though.

In conclusion the RBM target of ensuring that 80% of children less than five years receive effective anti-malarial drugs within 24 hours of fever onset is yet to be achieved and particularly in equitable way across SSA. More work is required to understanding the reasons for poor access to care, especially among the poorest people as a first step towards improving coverage[58]. Situation-specific

options of drug delivery strategies – country-specific and contextualised strategies, for going to scale are needed to reach the poorest people and reduce inequalities in health. Rigorous evaluations of effectiveness and costs of different delivery strategies in achieving and sustaining high population coverage at adequate quality levels are similarly required. Carefully planned policies on the over-the-counter medicines and community-based approaches in malaria management provide a possible immediate alternative delivery strategy of ACTs across most of the malaria endemic countries in Africa.

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Table 1: Reported Fever occurrence and Socio-economic disparities in Fever prevalence and treatment seeking in all sectors and public health sector in the surveyed countries

	Proportion of children with a fever in the last two weeks[1]			Treatment seeking in all Sector and public health sector[1]				
Countries[2]	**Fever Occurrence**			**All sectors**			**Public health sector**	
Central and west Africa	*Number*	*%*[3]	*Concentration index*	*Number*	*%*[4]	*Concentration index*	*%*[4]	*Concentration index*
Ghana (2003)	3530	21.3 (20, 23)	0.008 (-0.019, 0.035)	751	72 (68, 76)	0.015 (-0.029, 0.060)	40 (35, 44)	0.064 (-0.047, 0.175)
Senegal (MIS 2006)	4578	37.3 (35, 39)	-0.568 (-0.585, -0.551)	1734	56 (53, 59)	0.037 (-0.003, 0.076)	33 (31, 36)	**0.062** **(0.011, 0.114)**
Cameroon (2004)	7281	23.7 (22, 25)	0.052 (-0.002, 0.105)	1791	65 (62, 68)	**0.038** **(0.005, 0.070)**	29 (26, 32)	0.028 (-0.021, 0.077)
Guinea (2005)	5641	33.7 (31, 36)	-0.045 (-0.079, -0.012)	1791	54 (50, 58)	**0.055** **(0.012, 0.098)**	29 (25, 33)	**0.157** **(0.092, 0.221)**
Congo Brazzaville (2005)	4435	23.2 (21, 25)	-0.021 (-0.052, 0.010)	1002	65 (60, 71)	**0.055** **(0.035, 0.076)**	41 (36, 46)	**0.060** **(0.027, 0.093)**
Nigeria (2003)	5186	31.0 (29, 33)	-0.063 (-0.144, 0.018)	1603	73 (69, 77)	**0.072** **(0.045, 0.100)**	23 (20, 27)	**0.228** **(0.168, 0.288)**
Burkina Faso (2003)	9365	36.7 (35, 39)	-0.024 (-0.077 , 0.029)	3427	45 (42, 48)	0.073 (-0.022, 0.168)	31 (28, 34)	**0.175** **(0.070, 0.280)**
Mali (2006)	12437	17.9 (17, 19)	-0.028 (-0.087, 0.031)	2094	47 (43, 50)	0.074 (-0.018, 0.167)	29 (68, 62	**0.124** **(0.024, 0.223)**
Niger (2006)	8209	26.8 (24, 29)	-0.048 (-0.081, -0.015)	2170	62 (58, 66)	**0.085** **(0.048, 0.122)**	28 (25, 32)	**0.203** **(0.159, 0.248)**
Senegal (2005)	10106	29.8 (28, 31)	-0.002 (-0.024, 0.021)	2907	55 (52, 59)	**0.094** **(0.049, 0.138)**	33 (30, 36)	**0.095** **(0.069, 0.122)**
Chad (2004)	4926	34.3 (30, 38)	0.022 (-0.050, 0.095)	1547	51 (46, 56)	**0.126** **(0.047, 0.206)**	10 (7, 12)	**0.445** **(0.254, 0.635)**
Benin (2006)	14682	28.6 (27, 30)	-0.029 (-0.089, 0.032)	4204	65 (62, 67)	**0.635** **(0.593, 0.677)**	26 (24,27)	**0.099** **(0.015, 0.183)**
East & Southern Africa								
Uganda (2006)	7593	40.9 (38, 43)	-0.074 (-0.109, -0.039)	3091	83 (81, 84)	0.002 (-0.019, 0.023)	28 (25, 31)	-0.109 (-0.145, -0.074)

Table 1: *Continued*		**Fever**			**All**	**Sectors**	***Public***	***Health sector***
	Numbers	*%*	*Concentration index*	*Number*	*%*	*Concentration Index*	*%*	*Concentration index*
Tanzania (2004)	7852	24.4 (22, 26)	-0.026 (-0.039, -0.012)	2094	84 (81, 86)	**0.031** **(0.004, 0.057)**	49 (45, 53)	0.009 (-0.033, 0.052)
Kenya (2003)	5447	40.6 (39, 42)	0.006 (-0.027, 0.038)	2215	68 (65, 71)	**0.032** **(0.021, 0.043)**	29 (26, 32)	0.006 (-0.051, 0.063)
Malawi (2004)	9858	37.1 (36, 39)	-0.052 (-0.093, -0.010)	1977	61 (58, 64)	0.0361 (-0.002, 0.074)	23 (21, 26)	**0.096** **(0.038, 0.155)**
Zimbabwe (2005)	4875	7.5 (6, 9)	-0.024 (-0.076, 0.027)	391	45 (40, 51)	**0.065** **(0.009, 0.120)**	22 (18, 27)	**0.119** **(0.010, 0.227)**
Rwanda (2005)	7752	26.2 (25 , 28)	-0.008 (-0.034, 0.017)	2001	55 (52, 58)	0.067 (-0.005, 0.140)	24 (22, 26)	0.082 (-0.005, 0.169)
Mozambique (2003)	9129	26.7 (25, 28)	0.0003 (-0.045, 0.045)	2322	58 (55, 61)	**0.090** **(0.070, 0.109)**	50 (47, 53)	**0.109** **(0.088, 0.131)**
Madagascar (2003/04)	5088	20.6 (18, 23)	-0.052 (-0.097, -0.007)	1040	43 (37, 48)	**0.115** **(0.097, 0.133)**	27 (22, 32)	0.018 (-0.012, 0.048)
Ethiopia (2005)	9002	18.7 (17, 20)	-0.027 (-0.052, -0.002)	1587	19 (16, 22)	**0.235** **(0.090, 0.381)**	14 (11, 17)	**0.219** **(0.065, 0.373)**

Key:

The table is sorted by regions and concentration index(CI) of treatment seeking in all sectors; The CI values indicating statistically significant pro-poor treatment seeking are underlined while pro-rich treatment seeking are in **bold**. [1]All values in brackets are 95% Confidence Interval; [2]values in bracket show when(year) the demographic health surveys were done, Senegal had the only malaria indicator survey(MIS); [3]% - is the proportion of children who had fever in two weeks prior to the survey; [4]% - proportion of children who reported seeking fever treatment in the respective health sector, here, all sectors and public sector; percentages rounded-off due to space constrains

Table 2: Treatment seeking in private medical, retail, community sectors and traditional practice and associated socio-economic disparities among children who had fever in the two weeks preceding the surveys in Sub-Saharan Africa.

Countries	**Private Medical**[1]		**Retail**[1]		**Community-based**[1]		**Traditional practice**[1]	
Central & West Africa	*%*[2]	*Concentration index*	*%*[2]	*Concentration index*	*%*[2]	*Concentration Index*	*%*[2]	*Concentration index*
Ghana (2003)	7 (5, 10)	**0.307** **(0.186, 0.428)**	25 (21, 30)	-0.101 (-0.205, 0.002)	2 (1, 4)	-0.249 (-0.61, 0.112)	1 (0.6, 2)	-0.242 (-0.524, 0.041)
Senegal (MIS 2006)	5 (4, 7)	**0.395** **(0.217, 0.572)**	7 (6, 8)	0.046 (-0.084, 0.176)	12 (10, 13	-0.196 (-0.297, -0.096)	5 (4, 6)	-0.283 (-0.506, -0.061)
Cameroon (2004)	12 (10, 14)	**0.248** **(0.193, 0.302)**	19 (16, 22)	-0.038 (-0.083, 0.006)	6 (5,7)	-0.100 (-0.173, -0.026)	2 (1, 3)	-0.307 (-0.454, -0.161)
Guinea (2005)	3 (1, 4)	**0.560** **(0.428, 0.692)**	18 (16, 21)	-0.100 (-0.185, -0.016)	5 (4, 7)	-0.146 (-0.282, -0.009)	10 (8, 12)	-0.272 (-0.433, -0.112)
Congo Brazzaville (2005)	4 (3, 6)	0.080 (-0.039, 0.199)	17 (13, 20)	-0.004 (-0.092, 0.084)	4 (3, 6)	0.134 (-0.013, 0.280)	0.5 (0, 1)	-0.383 (-0.789, 0.024)
Nigeria (2003)	8 (6, 10)	**0.335** **(0.136, 0.533)**	42 (37, 46)	-0.034 (-0.139, 0.070)	3 (1, 4)	-0.194 (-0.397, 0.010)	4 (2, 5)	-0.360 (-0.601, -0.118)
Burkina Faso (2003)	0.7 (0.4, 1)	**0.565** **(0.406, 0.725)**	11 (8, 14)	-0.179 (-0.264,-0.095)	3 (2, 4)	-0.195 (-0.309, -0.080)	5 (4, 6)	-0.240 (-0.324, -0.157)
Mali (2006)	2 (1, 3)	**0.405** **(0.051, 0.758)**	12 (10, 15)	-0.042 (-0.204, 0.119)	4 (3, 5)	-0.0343 (-0.161, 0.093)	12 (10, 4.8)	-0.028 (-0.138, 0.082)
Niger (2006)	1 (0.6, 2)	**0.674** **(0.392, 0.956)**	33 (29, 37)	-0.066 (-0.136, 0.005)	0.7 (0.3,1)	**0.487** **(0.378, 0.596)**	2 (1, 3)	-0.2437 (-0.383, -0.105)
Senegal (2005)	5 (3, 10)	**0.505** **(0.376, 0.635)**	15 (13, 18)	0.024 (-0.026, 0.073)	4 (3, 5)	-0.029 (-0.278, 0.219)	2 (1.7, 3)	-0.051 (-0.152, 0.049)
Chad (2004)	2 (1, 3)	**0.352** **(0.249, 0.454)**	38 (33, 44)	-0.002 (-0.110, 0.102)	2 (1, 3)	0.006 (-0.106, 0.117)	2 (0.8, 3)	-0.479 (-0.700, -0.257)
Benin (2006)	10 (9, 11)	**0.248** **(0.035, 0.462)**	21 (19, 23)	-0.020 (-0.042, 0.002)	11 (10, 12	-0.024 (-0.035, -0.013)	2 (1.6, 3)	-0.124 (-0.312, 0.064)
East & southern Africa								
Uganda (2006)	45 (42, 48)	**0.070** **(0.023, 0.116)**	8 (7, 10)	**0.043** **(0.010, 0.077)**	6 (4, 7)	-0.120 (-0.294, 0.055)	0.7 (0.3, 1)	0.121 (-0.052, 0.294)
Tanzania (2004)	13 (11, 15)	0.028 (-0.101, 0.157)	22 (19, 25)	-0.038 (-0.146, 0.070)	2 (1, 3)	-0.269 (-0.558, 0.021)		
Kenya (2003)	18 (15, 20)	**0.143** **(0.024, 0.262)**	22 (18, 24)	-0.045 (-0.066, -0.024)	2 (1, 3)	0.057 (-0.264, 0.378)	0.9 (0.5, 2)	-0.349 (-0.574, -0.124)

Table 2: Continued	Private Medical		Retail		Community		Traditional	
Countries	%	*Concentration Index*	%	*Concentration Index*	%	*Concentration Index*	%	*Concentration Index*
Malawi (2004)	7 (5, 8)	0.172 (-0.036, 0.380)	30 (27, 33)	-0.033 (-0.080, 0.015)	1 (0.7, 2)	-0.187 (-0.295, -0.079)	3 (2, 4)	-0.099 (-0.221, 0.024)
Zimbabwe (2005)	3 (1, 6)	-0.066 (-0.414, 0.282)	15 (11, 20)	**0.212** **(0.029, 0.394)**	7 (5, 11)	-0.262 (-0.486, -0.038)	4 (2, 7)	-0.287 (-0.677, 0.104)
Rwanda (2005)	4 (3, 5)	**0.411** **(0.192, 0.629)**	18 (16, 20)	**0.049** **(0.010, 0.087)**	10 (8, 12)	-0.074 (-0.144, -0.003)	6 (5, 8)	-0.045 (-0.159, 0.068)
Mozambique (2003)	2 (1, 3)	0.030 (-0.278, 0.337)	0.6 (0.2, 0.9	**0.574** **(0.437, 0.711)**	5 (4, 7)	-0.139 (-0.276, -0.003)	3 (2, 4)	-0.314 (-0.600, -0.028)
Madagascar (2003/04)	12 (9, 15)	**0.364** **(0.259, 0.470)**	4 (2, 6)	-0.350 (-0.567, -0.134)	1 (0.1, 2)	-0.059 (-0.522, 0.405)	1 (0.4, 2)	-0.396 (-0.708, -0.083)
Ethiopia (2005)	4.0 (2.0, 5.0)	**0.342** **(0.142, 0.542)**	2.0 (1.0, 3.0)	**0.357** **(0.038, 0.675)**	0.4 (0.0, 0.8	-0.158 (-0.757, 0.441)	0.4 (-0.1, 0.8)	0.044 (-0.287, 0.374)

Key:

The concentration index values indicating statistically significant pro-poor treatment seeking are underlined while pro-rich treatment seeking are in **bold**. [1]All values in brackets are 95% Confidence Interval; [2]% - proportion of children who reportedly sought fever treatment in the respective health sector, here private, retail and community-based sectors and traditional practice

Table 3: Comparison of socio-economic Inequalities in fever treatment seeking in Private medical, Retail, and Community-based Relative to Public Health drug delivery system

	Sub-Saharan Africa			Central & west Africa			East and southern Africa		
Delivery system	*Median %[1]*	*Median CI[2]*	*p[3]*	*Median %[1]*	*Median CI*	*p[3]*	*Median %*	*Median CI*	*p[3]*
Public health	29.1 (24.2, 32.6)	0.096 (0.060, 0.157)	-	29.2 (27.0, 33.0)	0.111 (0.063, 0.189)	-	26.6 (23.4, 29.1)	0.082 (0.009, 0.109)	-
Private Medical	5.0 (2.6, 9.8)	0.335 (0.143, 0.405)	**<0.001**	4.7 (1.7, 7.6)	0.373 (0.278, 0.533)	**0.004**	6.7 (3.5, 13.2)	0.143 (0.030, 0.342)	0.1
Retail-markets	18.0 (10.9, 22.1)	-0.033 (-0.045, 0.043)	**0.03**	18.6 (13.8, 29.3)	-0.036 (-0.083, -0.003)	**0.002**	14.9 (3.7, 21.7)	0.043 (-0.038, 0.212)	0.7
Community-based	3.9 (1.9, 5.5)	-0.120 (-0.194, -0.029)	**<0.001**	4.0 (2.3, 5.7)	-0.067 (-0.194, -0.009)	0.02	2.1 (1.4, 5.5)	-0.139 (-0.187, -0.074)	**0.02**

Key: Values in brackets are inter quartile ranges; [1] - overall median proportion of children reportedly seeking fever treatment; [2] – overall median concentration index (CI); [3]p-values from Wilcoxon signed rank test

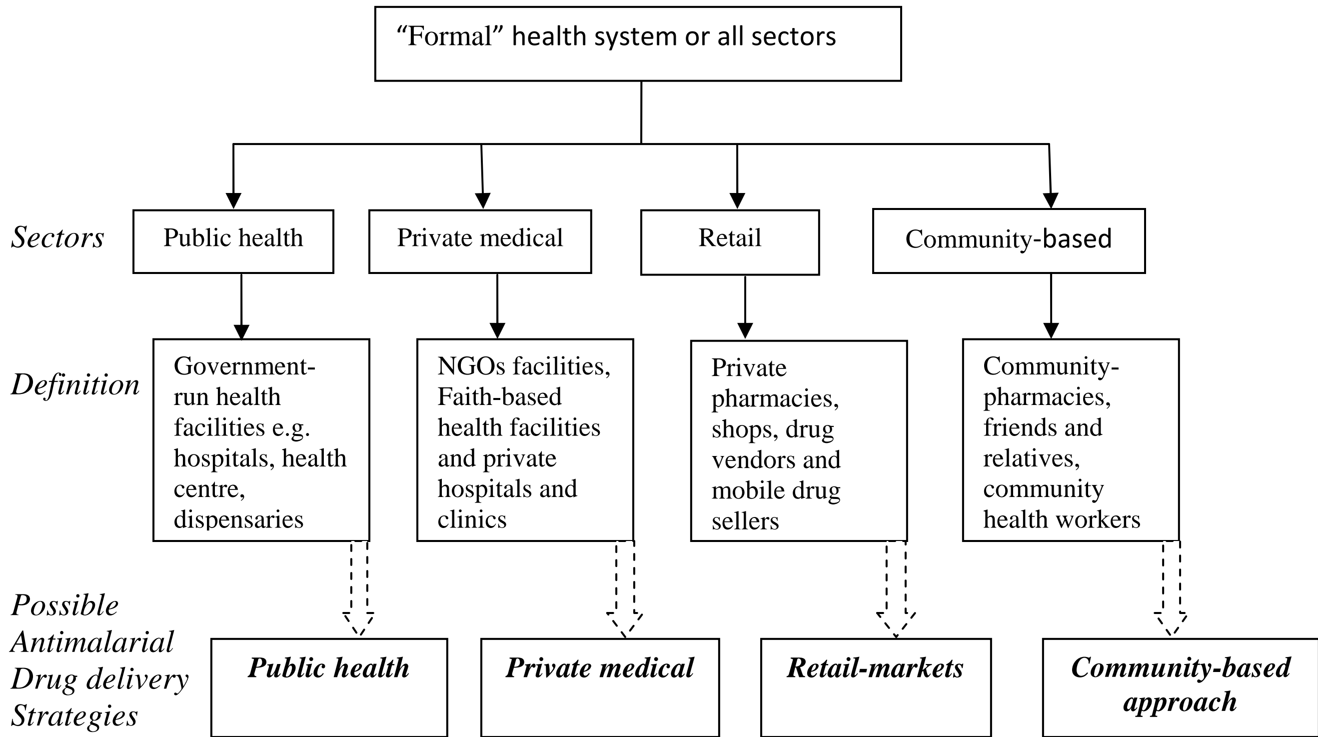

Figure 1: an illustration on the classification of the health system used in the study

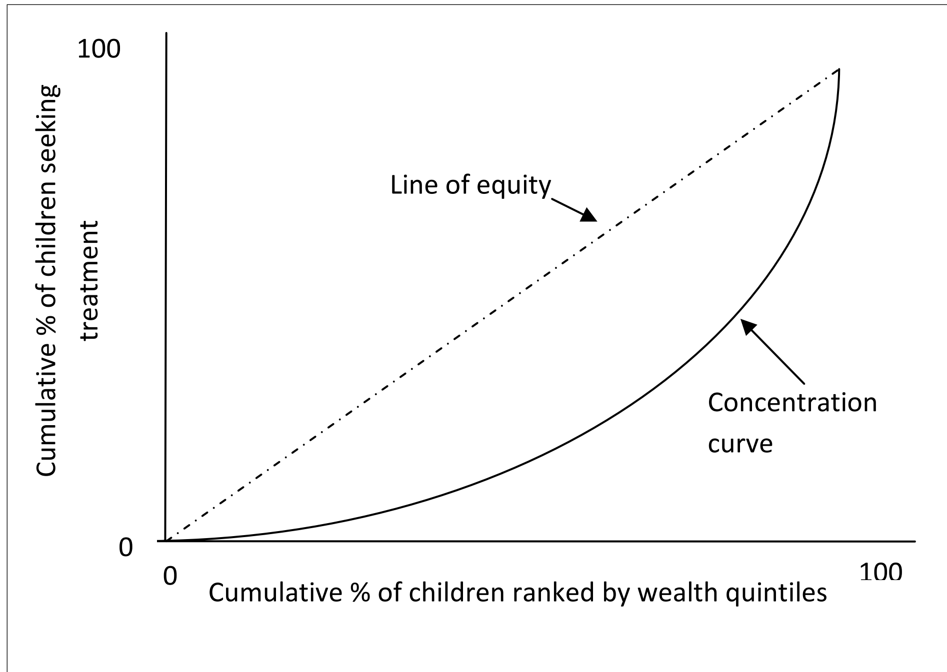

Figure 2: Diagram illustrating the calculation of concentration index; CI is equal to twice the area between concentration curve and line of equity

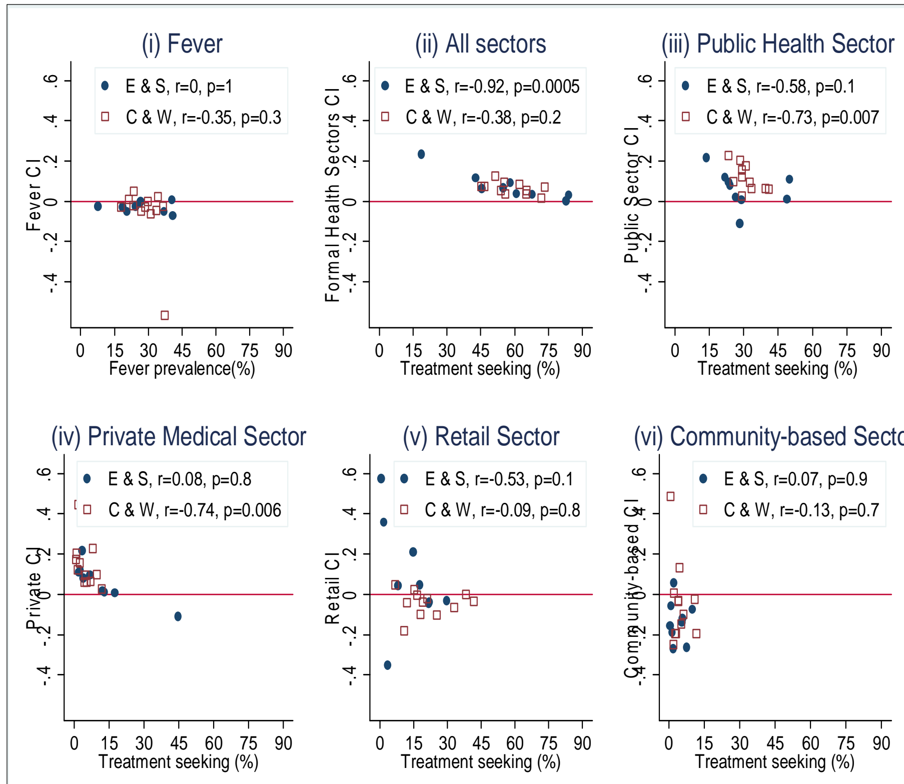

Figure 3: comparison of concentration index (CI) in i) fever prevalence; and by proportion of children under five years who reportedly sought fever treatment from ii) all sectors, iii) public, iv) private medical, v) Retail and vi) community-based sectors in East and southern (E&S) African countries and in central and west (C& W) African countries. The horizontal line in y-axis shows the point of equality in treatment seeking by wealth quintiles

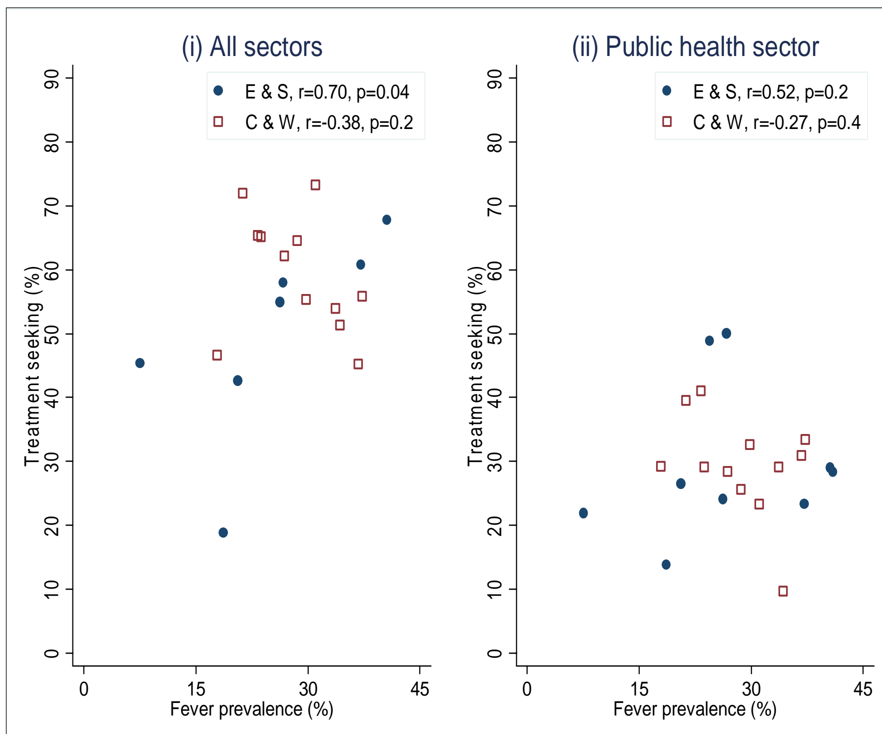

Figure 4: Comparison the treatment seeking in (i) all sectors and (ii) public sector by proportion of children who had fever two weeks preceding the survey in East and southern (E&S) African countries and in central and west (C&W) African countries

APPENDICES

1. Project approval form
2. Ethical application form