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FORUM SUMMARY

Consultative Forum on AMFm—The Affordable Medicines Facility-malaria

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CONSULTATIVE FORUM ON AMFM—THE AFFORDABLE MEDICINES FACILITY-MALARIA
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Resources for the Future (RFF) convened a Forum of operational experts, scientists, economists, and policymakers to consider the best available evidence to address issues still of concern to some stakeholders regarding the large-scale implementation of the Affordable Medicines Facility-malaria (AMFm).

Each year malaria sickens 300 million people and kills almost a million children. When malaria strikes, prompt effective drug treatment is the only cure. Over the past half century, the armamentarium of effective antimalarial drugs has been depleted as malaria parasites have become resistant to the few drugs suitable for widespread use. There remains a single class of antimalarials still effective everywhere—artemisinins. Scientific experts have argued that we must do everything possible to prevent resistance developing to artemisinins. The World Health Organization has made clear that an essential step in preserving effectiveness is using artemisinins *only* in combination with other drugs, which dramatically lowers the probability that resistant strains will survive and emerge to spread around the globe, which was the case in the past when "monotherapy" was the norm. The primary objectives of AMFm are to expand access to effective antimalarials and to protect the effectiveness of artemisinins and other novel antimalarials by making combination treatments such as ACTs available at a low price.

The questions that have been raised include the following:

- Are artemisinin-based drugs safe for use during pregnancy, particularly during the first trimester?
- Do the benefits of artemisinin combination therapies (ACTs) in patients with febrile illness but without a definitive malaria diagnosis outweigh the downside risk, specifically the lost opportunity to treat them for non-malaria infections?
- Should diagnostic tools, particularly rapid diagnostic tests (RDTs), accompany the roll-out of AMFm to ensure that only those with malaria receive ACTs?
- Is it likely that increased access to ACTs resulting from AMFm would decrease the time until artemisinin resistance emerges and spreads compared with what would be expected in the absence of AMFm?
- Will AMFm achieve low retail prices for consumers at the point of purchase, or will the subsidy be "captured" by others in the distribution process?
- What measures could be undertaken to ensure that the antimalarials subsidized by AMFm reach the very poor?

The Forum provided an opportunity for various stakeholders to discuss experiences designed to test, or those that serendipitously mimic, AMFm—particularly in the informal private sector, where AMFm is likely to have its greatest impact. In addition to answering specific questions about product flow, mark-ups and end-user prices, these experiences can shed light on whether the global subsidy idea can

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translate into a system in the real world that will both increase access to ACTs and minimize the use of monotherapies, especially artemisinin monotherapies.

At the Forum, original analyses addressing all the major issues were presented and additional lessons were drawn from pilot experiences. The second day focused on the history of the conceptual basis of AMFm and the basis for institutional and endemic-country support to AMFm. Three formal papers were prepared for the Forum and will be issued by RFF in final form (they are currently available in near-final form):

Opportunities and Threats in Targeting Antimalarials for the AMFm: The Role of Diagnostics
Christopher J.M. Whitty, Heidi Hopkins, Evelyn Ansah, Toby Leslie, and Hugh Reyburn

AMFm: Reaching the Poorest of the Poor with Effective Malaria Drugs
Ricardo Bitran and Bernardo Martorell

Distribution of Artemisinin-Based Combination Therapies through Private Sector Channels: Lessons from Four Country Case Studies
Oliver Sabot, Shunmay Yeung, Franco Pagnoni, Megumi Gordon, Nora Petty, Kristen Schmits, and Ambrose Talisuna

In addition, Professor Nick White presented unpublished data relevant to the issue of safety of ACTs in pregnant women. This paper is being submitted to a medical journal and will be available in due course.

AMFm Defined

AMFm is a financing platform designed to greatly increase financial and geographic access to ACTs in public, private and non-profit sectors through a global subsidy. By applying the global subsidy near the top of the distribution chain, good quality ACTs will be sold cheaply at wholesale, flow through the existing distribution channels—public and private—and emerge at prices low enough for most people to afford in malaria-endemic countries. AMFm is not, itself, a distribution mechanism.

Reducing the use of all monotherapies, but particularly artemisinin monotherapies, is the second major goal of AMFm. Where artemisinin monotherapies make up a significant share of the market (especially in parts of Asia), AMFm should drive them out, and where price has kept them scarce (in Africa), it will forestall their widespread introduction.

AMFm is likely to have the greatest impact in the informal private sector in rural areas, where the public sector is least accessible. In Africa, ACTs will replace chloroquine, sulfadoxine-pyrimethamine (SP), and other inexpensive, but partially or entirely ineffective, antimalarials that people now purchase. In other parts of the world, ACTs will replace older drugs and artemisinin monotherapies that are now available.

Sense of the Meeting

The need for mechanisms to expand access to antimalarials was not questioned. Nor was the need to protect artemisinins—the one class of drug that remains effective against malaria everywhere—from

premature loss to drug resistant organisms. The foundation for delaying drug resistance is use of artemisinins only when coformulated with other antimalarials in ACTs.

Paying the full retail private sector cost of ACTs is not viable for most people with malaria. At $5-10 per course, compared with 50 cents or less for the older, now ineffective drugs, they are simply too expensive. Although price is not the only barrier that people face in accessing effective antimalarials, it is likely the most important one. Forum participants agreed that it was not feasible, in the short run, to build health infrastructure capable of delivering ACTs to the periphery, where most malaria occurs.

If ACTs are to be used widely, prices must be lowered for both public and private sector buyers External assistance through bilateral and multilateral funding programs have been used to purchase ACTs for use in public sector facilities, and financing has been provided for other formal healthcare sites as well (e.g., hospitals and clinics run by NGOs). In spite of these efforts, the availability of ACTs in the public sector remains low. In Zambia, for example, all the major malaria funding programs—the U.S. President's Malaria Initiative (PMI), the World Bank Booster Program for Malaria, and the Global Fund to Fight AIDS, Tuberculosis and Malaria—have made large amounts of funding available. Yet in 2006 (the most recent year data were available), *far more ineffective SP than effective Coartem, the ACT used in that country, was given to children in public clinics in Zambia.*

In 18 African countries that conducted surveys in 2007 or 2008, overall, only three percent of febrile children received ACTs, while more than 10 times as many got other antimalarials. Moreover, development assistance has not been directed at the informal private sector—shops and drug sellers in towns and villages—where people contract, suffer and die from malaria. More comprehensive health care—including diagnosis and treatment of infections other than malaria—is a clear goal, but the immediate tradeoff is between ineffective antimalarials and effective ACTs. Ongoing and future efforts to improve health care will not be impeded by AMFm.

Agreement from Forum participants seemed to be unanimous up to this point. A few participants questioned whether AMFm was the best way to achieve widespread access through both public and private sectors in all areas of endemic countries. However, the group recognized that credible alternatives have not been formally proposed nor is an analysis available that sets out what can be achieved by continuing with traditional malaria funding strategies. There was general, though not unanimous, agreement that the case in support of AMFm is positive and strong, albeit with a need to learn from the proposed rollout through careful monitoring and operational research.

AMFm has been tested in pilots but not yet been implemented on the scale at which it was originally conceived. Over the last four years, a plan for starting AMFm has been developed based on analysis of malaria patterns and drug cost, consumption, and distribution data. The concerns raised have been studied. Many of these concerns are not specific to AMFm, but apply to widespread access to ACTs, regardless of how this is achieved. Use by pregnant women, by people with other causes of fevers, and the expanded use of RDTs are issues that concern the malaria community under current conditions and will, of necessity, be of continuing concern regardless of the future of AMFm. Some—such as whether the subsidy will be captured in the supply chain before reaching consumers—are specific to AMFm, and have been addressed to a limited extent.

However, as with any ambitious effort to expand access to treatment, questions remain about the effectiveness of AMFm and about what measures countries can take so that its citizens reap the greatest

benefit from it (in particular, ensuring over-the-counter status). Much will be learned about AMFm only as it is rolled out. It is clear, however, that the pilot stage must be substantial—possibly in countries that are linked both in geography and private sector supply chains—to avoid major cross-border transport of ACTs from countries that are part of an AMFm pilot to those that are not. This may not be significant over the short term, but is all but guaranteed in the longer term and will destroy the price-reducing value of AMFm, the avoidance of artemisinin monotherapies, and the reduction in sales of substandard and counterfeit ACTs.

Technical discussions around the issues listed above (and discussed in more detail below) were persuasive that the benefits of AMFm outweigh the risks. Specifically:

- ACTs appear to be at least as safe for pregnant women, even in the first trimester, as other antimalarials, and safer than a clinical case of malaria; use in pregnancy should be monitored to the extent possible.
- Evidence from modeling suggests that AMFm would delay the emergence and spread of resistance to artemisinins, even at higher levels of use than would occur without it, because of the effect of out-competing artemisinin monotherapy on price.
- The history of other antimalarials indicates that the deployment of effective drugs does more good than "saving" them.
- Targeting antimalarials to malaria cases is a clear goal. In the periphery, this means using RDTs to discriminate malaria from non-malarial fevers. However, there exist many unresolved challenges in using RDTs on a broad scale. Subsidies for RDTs may be needed to align financial and public health incentives, but formulating such plans requires information not yet available. Currently, eligibility for AMFm financing should not be tied to expanding the use of RDTs.
- In the pilot program in Tanzania designed to test the AMFm concept, a high-level subsidy is being passed through to consumers in the form of low end-user prices; other relevant experiences have had similar results.

Implementation of AMFm, initially in pilot countries, will require resources for operational research to learn how best to make ACTs available in a variety of circumstances. With or without AMFm, better monitoring of drug effectiveness and resistance to both artemisinins and partner drugs is needed. Finally, it is essential that the impact of AMFm on malaria cases and mortality be evaluated through ongoing surveillance.

AMFm will not solve all the problems of access to ACTs. Regardless of the approach, some segment of the population will inevitably be denied access to ACTs even at the low post-subsidy prices. Though providing ACTs free to the very poorest would be ideal (and plans to do so should be pursued where possible), this cannot be accomplished quickly or easily on a large scale nor is it likely to be necessary.

At the same time that AMFm is initiated, the use ITNs (insecticide-treated bednets) and IRS (indoor residual pesticide spraying) is expanding in endemic countries, and these measures, which can reduce the burden of malaria, will also lengthen the useful life of artemisinin compounds. Disaggregation of the separate impacts of all the interventions will be difficult. In the end, the reduction in malaria mortality and morbidity and a decline in child mortality are the outcomes that are important.

Key Points on Special Topics

Artemisinins in Pregnancy: Risks and Benefits *(based on the presentation of Professor Nick White, Wellcome Trust–Mahidol University and Oxford University)*

Malaria is a dangerous disease for pregnant women and their unborn children. For women, the risk of severe malaria, death, and severe anemia are greatly increased in pregnancy. Fetal loss is more likely, and for liveborn babies, birthweight is decreased and anemia is more common after malaria during the pregnancy. Malaria prevention is the best intervention, but some pregnant women will contract malaria. The first trimester, before many women realize that they are pregnant, is the riskiest time in terms of fetal development and the adverse impact of malaria in pregnant women.

Clinical trials of antimalarials that intentionally include pregnant women are rare, for the same reasons that trials of any drug in pregnancy are rare. Since the thalidomide experience 50 years ago, newly developed drugs are almost never tested in pregnant women, especially during the first trimester, when interference in organ formation can cause birth defects. As a result, new medicines often carry the caveat that they should not be used by pregnant women because information is lacking, rather than because of knowledge that the drugs are harmful.

In a systematic review of artemisinins in pregnancy, only 945 pregnancies (123 during first trimester) were found in 14 studies. Excess adverse effects were not found in either the first or later trimesters, but the numbers are too small for firm conclusions.

The most complete and informative dataset comes from the Shoklo Malaria Research Unit (SMRU) near the border between Thailand and Myanmar. Over the past 20 years, 13,000 women were monitored from the first trimester of pregnancy. Of these women 1,715 were treated for 2,165 episodes of malaria within the first trimester, including 263 courses of treatment with artemisinins, and the rest with other antimalarials. Some women were treated more than once during the first trimester.

Analyses of the SMRU data confirm that clinical malaria, especially with larger numbers of parasites in the blood, and early in pregnancy, increases the risk of miscarriage. In contrast, treatment with antimalarial drugs of any type, including artemisinins, significantly reduces this risk. No significant increases were found in stillbirths, congenital anomalies, or low birthweight with artemisinins compared with other drugs.

Early diagnosis and treatment of malaria with artemisinin derivatives is effective and safe, based on available data. Malarial disease is inherently risky and should be treated.

Targeting ACTs by Expanding the Use of RDTs

A central objective of AMFm is to extend access to ACTs relatively quickly to a large group of people. Expanded access means that more people with febrile illnesses caused by an infection other than malaria are likely to take ACTs instead of the ineffective antimalarials they take currently. A reasonable concern about the widespread use of ACTs is that overall, the harm caused by inappropriate antimalarial use and the lost opportunity to treat a febrile illness appropriately may outweigh the benefit of providing ACTs to those with malaria. One solution has been to improve the quality of diagnosis by wider use of rapid diagnostic tests (RDTs). Currently, the choice of diagnostic technology for clinical use

in endemic countries is between microscopy (the gold standard) and RDTs. In villages at the periphery, RDTs are the only realistic option because qualified technicians and equipment are not available.

RDTs have a number of technical limitations, including an all-or-none test result, variable heat stability (with the result that they may be ruined by excessive heat), and in diagnosing non-falciparum malaria. RDT use also raises certain safety issues. First, false negative tests can lead to untreated malaria. There is also concern about deploying a technology that depends on blood sampling by relatively untrained users in areas of high HIV and hepatitis B prevalence.

Behavioral issues are also important. In the formal health care sector in Africa there is strong evidence (and in Asia, suggestive evidence) that positive results from microscopy lead to prescription of antimalarials, but about half the time, so do negative tests. Using RDTs rather than microscopy does not lead to any difference in this tendency to ignore negative tests and over-prescribe antimalarials. This is happening today with ACTs financed through traditional means in public hospitals and clinics.

Clearly, despite potential problems, improving diagnosis through RDTs alongside AMFm has the potential to improve the management of malaria and other febrile illnesses, and to improve the cost-effectiveness and sustainability of AMFm. However, issues around diagnostics, while clearly important, do not provide a reason to delay implementing AMFm. Operational research to identify whether, and if so, how, to deploy diagnostics as part of AMFm are a priority and should be undertaken as soon as possible. Subsidies for RDTs may be needed to align the economic incentives with the public health incentives.

Reaching the Very Poor with ACTs

By lowering end-user prices, AMFm will dramatically increase the proportion of the population that can afford ACTs to about the same level as those who can afford chloroquine or similar antimalarials. However, the very poor who cannot now afford any antimalarial—mainly the lowest income quintile in sub-Saharan Africa, those who make about $0.50 per day or less—will not be able to buy an adequate course of ACTs, even subsidized down to chloroquine prices (close to the cost of delivery alone through the private sector). A minority of the very poor in most countries have access to ACTs free of charge or at extremely low prices in public facilities, through community health workers or other special programs (which will not be disturbed by AMFm). Others could be reached by subsidies that would result in still greater price-lowering or free distribution, though applying these additional subsidies (either targeted at the very poor or untargeted to lower prices for everyone) will not be administratively simple and cannot be accomplished at a global level. A thorough review (by Bitran and Martorell) of reaching the very poor with health commodities (both malaria-related and other), food, fuel, and educational services enumerates the approaches that have been used, how successful they have been, and their relevance to a subsidy for ACTs.

Subsidies can be complete or partial, resulting in zero or low cost, respectively. How individuals (or families) in need are targeted, and whether they need to be identified varies substantially.

Where entire villages or areas are mainly poor, *geographic targeting* may be appropriate, delivering ACTs directly to shops or public providers in those areas. This approach does not require identification of a subgroup of very poor. Others approaches, such as *targeted price subsidies* at the point of delivery in areas of mixed economic strata, usually involve vouchers, which can be distributed to the very poor

through other high-coverage events, such as immunization campaigns or prenatal visits. An administrative structure to identify the very poor and for shopkeepers to redeem vouchers are needed to make this type of subsidy work. Programs based on conditional price subsidies, cash transfers, targeting by self-selection or by type of service have also been reviewed.

The bottom line is that it appears possible to reach the very poor with ACTs, but the best way to achieve this will vary by locality, may be expensive relative to the value of the benefit delivered, and may be administratively complex—likely the same barriers that have kept the very poor from access to earlier antimalarials and to a range of other commodities and services. It will fall largely to ministries of health and malaria control programs to identify and implement (probably with external funding) the most appropriate approach for each locale.

Pilot Experiences

In Tanzania, a pilot project designed explicitly to test the AMFm concept has been under way for the past year. A pilot project of supplying coformulated ACTs through some private sector outlets also exists in Kenya. Because these were intended as pilot projects, both collected baseline data and have collected follow up data over time. In Cambodia, the first country to introduce an ACT subsidy in the private sector, surveys before and during implementation provide useful insight, although their comparison is not as robust as that in Tanzania and Kenya. Finally, a single survey, with limited data, was conducted during a subsidy initiative in Senegal.

The Kenya and Tanzania programs indicate that subsidies can lead to rapid uptake of ACTs from private sector outlets. In Tanzania, more than 40 percent of consumers chose ACTs over other antimalarials five months after the program was established. In the control district, ACTs were not very available and were not used. As expected, penetration into more remote areas was somewhat less, but still significant. Findings were similar in Kenya. Increased use of ACTs led to a corresponding decrease in the use of other therapies such as SP and amodiaquine.

The Cambodia experience presents a different and more complicated picture, and has less relevance to AMFm. Five years after the introduction of subsidized ACTs (blister packages of artesunate and mefloquine in separate tablets) in the private sector, tetracycline and artemisinin-based monotherapy were the most widely used antimalarials. There are many possible explanations for the low uptake of ACTs in Cambodia compared to the other countries. Unlike the situation in Africa, artemisinin monotherapies have been widely available for many years and consumers perceive them to be safe and effective. There was thus little incentive for consumers to switch to the combination therapies, especially because mefloquine may have unpleasant side effects. It is not possible to draw conclusions about the effect of price from the available data in Cambodia.

End-user prices of subsidized ACTs were low in Tanzania and Senegal. In Tanzania, the price for ACTs was similar to that for other common antimalarials, including in the more remote areas. In both Tanzania and Senegal, markups were in the expected range and no price gouging was noted. In Cambodia, however, prices averaged 70 percent above the recommended retail price.

The Senegal experience illustrates an important reality of many countries. Patients paid equivalent amounts for ACT treatment in the public and private sectors. This is particularly relevant in West

African countries where charges at public facilities are more common than in many other malaria-endemic countries. In Tanzania, for example, patients spent equally for malaria treatment from public and private sources.

Based on the experiences reported here, private-sector subsidies can play an important role in efforts to increase ACT coverage in many malaria-endemic areas. The differences between countries suggest strongly that it will be important to tailor approaches to specific conditions, though only close monitoring and operational research can guide the development of optimal approaches.

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Opportunities and Threats in Targeting Antimalarials for the AMFm: The Role of Diagnostics

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Executive Summary

Historically and today, a large proportion of patients with febrile illness in places where malaria is common are treated with antimalarial drugs, but without specific diagnosis. The exception to the lack of diagnosis has been blood smear slides examined under the microscope for malaria parasites, a practice limited largely to hospitals and formal clinics. Targeting antimalarials to those who have malaria and identifying and treating other causes of serious febrile diseases has long been a goal, but it is not yet achievable everywhere.

In rural villages, where health-care institutions are rare, chloroquine and SP have been the main malaria drugs available, offered by shops and street vendors and purchased for patients for empirical use. Replacing those drugs with ACTs is the purpose of AMFm and a necessary component of malaria control. ACTs are relatively safe and very effective. A person with malaria is likely to be helped, and a person without malaria is not likely to be hurt (even if treating the uninfected person is not desirable).

The key questions are whether the expanded use of ACTs made possible by AMFm, without immediate expansion of diagnostic tests for malaria, will do more harm than good, and whether rapid diagnostic tests (RDTs) should be linked to AMFm.

In the peripheral, nonformal, and private sectors, where AMFm is likely to have its greatest impact, RDTs are the only realistic option. Microscopy, to be cost-effective, depends on high throughput, which is likely only in the formal sector. But are currently available RDTs ready for widespread deployment? RDTs have a number of technical limitations, including an all-or-none test result, currently variable heat stability, and in diagnosing nonfalciparum malaria.

Safety needs to be taken seriously. There is a theoretical risk of RDTs leading to true cases of malaria not being treated, and of deploying a technology that requires blood sampling by relatively untrained users in areas of high HIV and hepatitis B prevalence.

In the formal health-care sector in Africa, health-care workers are responsive to positive malaria tests, using either microscopy or RDTs, prescribing antimalarials for virtually everyone who tests positive. But about half the time, a negative test elicits the same prescription. Data from Asia, though limited, reveal a similar picture. The reasons clinicians respond irrationally to diagnostic tests are complex and may be difficult or slow to change. Data from outside the formal sector are too scant to be informative.

The bottom line is that these problems are recognized and will exist with or without AMFm. Improving diagnosis and the use of diagnostic tests alongside AMFm (though not necessarily a direct part of it) has the potential to improve management of both malaria and other febrile illness as well as the cost-effectiveness and sustainability of AMFm. The impact of improved targeting is greatest in areas where incidence of is lower and other causes of febrile disease are relatively more important. R&D to solve some of the technical problems and operational research to develop better ways to deploy RDTs and to make diagnosis count are also needed.

Introduction

The opportunity to expand the use of effective antimalarials, in practice artemisinin combination therapies (ACTs), with the AMFm initiative is potentially a major step forward and undoubtedly very welcome, both within and outside the public sector. There is, however, a potential downside to expanding use in areas where diagnostic facilities are weak: increasing the number of febrile patients treated with an antimalarial may not translate into as large an increase in those who have malaria being treated with an antimalarial. There are many causes of febrile illness, and it is essential that antimalarial therapy is targeted as much as possible toward those who have the disease. This is important for several reasons.

First, important alternative diagnoses may be missed. Evidence is strong from many parts of Africa as well as outside it that the high burden of mortality in childhood is attributable to many treatable febrile illnesses; malaria is certainly not the only cause of death and in many settings is not even the most important (Olivar et al. 1991; Sowunmi and Akindele 1993; Ndyomugyenyi et al. 2007). Treating meningitis or pneumonia with an antimalarial, for example, is at best useless and possibly, if it leads to delays in diagnosis and appropriate treatment, even hazardous (Berkley et al. 1999; Reyburn et al. 2004; Berkley et al. 2005; Kallander et al. 2008; Orimadegun et al. 2008). The alternative to improved targeting of treatment for nonsevere febrile illness is syndromic management with antibiotics and antimalarials, but though this approach may have some attractions, it has very limited in-country support, with concerns about antibiotic resistance widely voiced.

Second, today's ACTs generally appear safe and well tolerated, but no drug is without risk (Maiteki-Sebuguzi et al. 2008). Treating malaria with an antimalarial is a balance of the relatively small risk of the drug against the very high risk of the disease. If, however, the great majority of those treated with an antimalarial do not have the disease and therefore cannot benefit, the risk-benefit changes presenting a significant safety issue for drugs, and especially newer drugs.

Third, the cost-effectiveness of any antimalarial program will substantially reduce if the majority of the money spent on antimalarials goes to treat people who do not have malaria (Snow et al. 2003; Yeung et al. 2008). This is potentially an important limitation on the long-term sustainability of funding, and in particular of maintaining widespread political support. Because the effects of upscaled malaria interventions (i.e., access to effective drugs and insecticide-treated nets) reduce incidence of disease, without diagnosis, cost-effectiveness will only decrease; the proportion of febrile cases with malaria decreases though there may be no great change in the number of cases administered antimalarials. Reducing drug waste is important in planning for efficient use of health-care resources.

Fourth, the risk of increasing the potential for initiation and particularly the spread of antimalarial drug-resistance, especially to the partner drugs in ACTs, and to a lesser extent, the artemisinins themselves, is small but real. Low levels of drug circulating in many individuals in a population is an ideal situation to speed up the spread of resistance (Payne 1988; Talisuna et al. 2004). Recent data suggest that artemisinin-tolerant parasites may be emerging on the Thai-Cambodian border, which the WHO recognizes as a potential global emergency with serious implications for malaria control efforts (WHO 2008). Strategies to delay the spread of resistance and preserve ACTs as effective antimalarial therapies are critical to long-term malaria control goals (White and Olliaro 1996; Duong et al. 2004).

Fifth, if a great proportion of those treated with an antimalarial do not get better because they are not actually suffering from malaria, this can undermine popular support for new and effective antimalarials.

Additionally, real gains (and losses) in malaria control programs can be missed when all fever cases are classified as malaria.

It is thus essential to move toward targeting antimalarials so that they go only to those with malaria. AMFm, by moving ACTs farther into the community, beyond the formal health-care system, could be a vehicle for better diagnostic practices—thus improving management of all causes of febrile illness. If diagnostic issues are ignored, AMFm could simply increase the amount of ACTs given to children who do not have malaria. The diagnostic issues are certainly not a reason to delay or stop AMFm; increasing the use of effective antimalarials in peripheral settings, where the poorest live, is essential. Technical decisions about AMFm must, however, take diagnostics and drug targeting into account if AMFm's potential is to be maximized.

There is now increasing evidence of a reduction in malaria transmission in many of the countries where malaria is a major problem (Barnes et al. 2005; Nyarango et al. 2006; Bhattarai et al. 2007; Okiro et al. 2007; Guerra et al. 2008; Sievers et al. 2008). This phenomenon is extremely welcome, and the provision of ACTs may well be contributing to the decrease, in some cases substantially. This means, however, that antimalarial targeting will become more rather than less important. A diagnostic system in which most febrile illness is treated with antimalarials is rational when most children with potentially fatal febrile illnesses have malaria. This approach becomes much less justifiable when only a minority do. This observation highlights a technical limitation with the current RBM Monitoring and Evaluation Reference Group (MERG) indicators, which emphasize the need for children with febrile illnesses, rather than febrile illness with parasitemia, to be treated with an effective antimalarial within 24 hours. This empiric approach makes sense in many settings but is less appropriate when malaria is a relatively smaller problem than bacterial disease. This is the situation for much of highland and urban Africa and increasingly for some previously highly endemic parts of rural Africa as well (Barnes et al. 2005; Nyarango et al. 2006; Bhattarai et al. 2007; Ndyomugyenyi et al. 2007; Okiro et al. 2007; Sievers et al. 2008).

The rest of this briefing summarizes the current knowledge on the diagnosis of malaria in the field, reviews technical aspects of malaria diagnostic tests, looks at the potential cost-effectiveness of these tests, and then examines the experience so far in trying to improve diagnostic practices within the formal health-care sector. It finishes with speculative discussion of the potential for extending diagnostic services into the nonformal sector, which is the where AMFm is likely to have its greatest impact, and the possible role of AMFm in facilitating greater use of rapid diagnostic tests (RDTs). This discussion is speculative because data on this topic are scarce, making it a target for operational research and evaluation of different strategies.

Diagnostic Tests for Malaria

It is widely accepted that clinical algorithms, which use only symptoms to identify those with malaria, are difficult to use and have low sensitivity and specificity (Redd et al. 1996; Luxemburger et al. 1998; Tarimo et al. 2001; Chandramohan et al. 2002). The options therefore are either to treat all individuals with a fever or recent history of fever, or to use a diagnostic test. For malaria, the choice of test is between microscopy, which identifies parasites directly in blood, and rapid diagnostic tests, which are immunochromatographic tests that detect malaria antigens in the blood. To summarize, light microscopy, provided it can be done well, remains the gold standard in settings when many patients are to be tested, but in more peripheral settings is unlikely to be either feasible or cost effective. Therefore, if diagnostic tests are to be considered for use in these peripheral settings most relevant for AMFm, the

choice is likely to be between rapid diagnostic tests or clinical diagnosis based solely on fever. Important differences between microscopy and RDT test types available are summarized in table 1.

Other approaches, such as using the polymerase chain reaction (PCR) and immunological tests for malaria are also available but are useful only for research in field contexts in Africa, Asia, and South America. There is no realistic probability of PCR becoming a useful clinical tool in low-resource health-care settings in the foreseeable future. Immunological tests, even when well performed, are unreliable for acute diagnosis of malaria, though they are useful in a number of other contexts, such as blood banks. We therefore concentrate on the two standard technologies of microscopy and rapid diagnostic tests and discuss possible developments to these within a five-to-ten year timeframe.

Microscopy

The mainstay of malaria diagnosis for the last 100 years has been light microscopy of blood stained with Field and Giemsa variations. A more recent development is fluorescence microscopy (QBC II), which reportedly improves sensitivity and user-effectiveness (Gray et al. 1991; Gay et al. 1996; Guy et al. 2007). The vogue for fluorescent technology seems to have largely passed though fluorescence microscopes are still used in some parts, particularly in East Africa where many were donated, but those that break tend not to be replaced and, in practice, they have had relatively little additional impact on light microscopy.

It is easy to write off light microscopy as yesterday's technology. That it has survived so long is largely because it is still the best method provided there are good microscopes, good slides and stains, and highly trained and motivated technicians with enough time. In expert hands, the lower limit of detection of malaria in thick and thin films is about 50 parasites/µl of blood (assuming a total RBC count of 5 x 10^6/µl of blood), which is equivalent to 0.001% of RBC infected parasites per micro-liter (Moody 2002). The detection of low level parasitemias may not have a great bearing on diagnosis in most African settings, given that high (and therefore relatively easily detected) parasitemia is the norm in clinical cases.

The microscopes used for diagnosing malaria have remained essentially unchanged for the last 50 years because they do their job effectively and are generally robust. They can be adapted to situations where there is no power, using sunlight reflected in mirrors as a light source, though sensitivity tends to decrease. A number of portable microscopes have been developed that are effective in certain situations. It is therefore premature to write an obituary for light microscopy, even though we do not anticipate any new technological developments. It suffers, however, from a number of flaws:

- The initial capital outlay is significant and the cost of employing trained technicians and supplying them with adequate reagents and equipment is not trivial. This cost is justified in high throughput settings, where the cost-effectiveness of microscopy tends to dominate that of any other diagnostic method (Jonkman et al. 1995; Lubell et al. 2007). Light microscopy is therefore likely to remain the ideal standard in hospital outpatient and other high-volume settings for the foreseeable future. Microscopy's cost-effectiveness decreases significantly as the throughput of true cases of malaria decreases, such as in clinics in the periphery, in pharmacist shops, and in community settings. Certain externalities, however, such as using the same staff and equipment for TB or stool tests, may increase cost-effectiveness in lower throughput settings.
- Providing new microscopes has proved relatively easy for donors and ministries of health, but maintaining them is far more challenging. Microscopes are relatively simple mechanically, but

problems with fungal hyphae and physical damage (to lenses, focusing mechanisms, and spare parts such as bulbs) mean that many microscopes are either unusable or usable only at standards far below optimal.

- The quality of slides and stains is often poor and frequent power outages are a significant problem when generators are not available.
- Training and maintaining staff morale are ongoing issues. Judged by a gold-standard of double-read research slides, many studies have demonstrated that sensitivity of microscopy in operational practice, even with recently replaced equipment, often falls below 70 percent and that specificity is equally poor (Durrheim et al. 1997; Stow et al. 1999; Coleman et al. 2002). Clinicians are aware of this deficiency, which is probably largely the reason for a widespread belief in African and Asian settings that "slide-negative malaria" is a common problem. Series from Europe and the United States, where resource constraints are fewer and equipment is of better quality, demonstrate that slide-negative malaria is in fact exceptionally rare, even in settings where most people are not immune and very low parasitemia can thus cause disease. Much more often, malaria is called slide-negative when the microscopy result is in fact false-negative because of poor slide preparation or examination technique. A negative cycle therefore tends to occur when clinicians ignore slide results, slide readers learn that clinicians ignore their results, slide reader motivation drops still further, and diagnostic accuracy decreases even more.

Various attempts have been made to improve microscopy training and equipment (Ssekabira submitted for publication). The general experience is that such efforts begin well but deteriorate rapidly. Maintaining an excellent microscopy service in high throughput settings is therefore an ideal, but often unrealized.

Rapid Diagnostic Tests

Rapid diagnostic tests (RDTs), commercially available as cassettes or dip-sticks, are increasingly common and have been shown effective in a variety of clinical settings. RDTs are performed by placing a drop of blood on a cassette or dipstick and applying a buffer solution to diffuse the blood across a membrane, which then shows control and test lines, similar to rapid HIV tests or pregnancy tests. RDTs detect parasite antigens (proteins) in whole blood. RDTs today are designed to detect one or more of three target antigens: histidine-rich protein 2 (HRP2), parasite lactate dehydrogenase (pLDH), and aldolase. The majority of RDTs on the market detect either HRP2 or LDH. More than 80 RDTs, mainly of these two types, are currently on the market, (WHO/WPRO 2008) with a relatively rapid turnover of manufacturers.

Currently available RDTs have a number of advantages and disadvantages compared with conventional microscopy. Several advantages are clear cut:

- RDTs are relatively simple to use, requiring minimal training to master the mechanics of test preparation and interpretation (Premji et al. 1994; Mayxay et al. 2004; Rennie et al. 2007; Harvey et al. 2008).
- RDT sensitivity and specificity in detecting parasitemia is comparable to good-quality microscopy,(Craig et al. 2002; Guthmann et al. 2002; Moody 2002; Hopkins et al. 2007) and therefore by definition better than an underskilled microscopist or a microscopist using poor equipment.

- In low throughput settings, RDTs are more cost effective than microscopy, and are therefore potentially ideal when only a few patients who might have malaria are seen per day (Bualombai et al. 2003; Shillcutt et al. 2008).
- RDTs do not require electricity or special laboratory equipment.
- RDTs are portable.

These last two advantages make them very useful for rapid screening, use in refugee settings and, of particular importance for the current discussions, use in remote or rural settings.

RDTs do have a number of limitations as well:

- Current tests are all-or-none, that is, results are either positive or negative, and do not allow for quantification of parasitemia. This is not a limitation in settings where people are not immune because any degree of parasitemia may signify a clinically significant infection. It is more of a problem where transmission is high (malaria is meso- to holo-endemic), and many children and adults (20 percent of the population might be typical) carry parasites at any given time, but remain asymptomatic and essentially well. If they present with another cause of febrile illness, they may well be correctly diagnosed as having malaria parasitemia, but the diagnosis may be misleading about the real cause of their illness if the parasite count is very low. Microscopy allows a quantitative assessment of parasitemia, which is more useful to clinicians in this setting. A patient with a low parasite count is likely to need treatment for malaria, but other potentially serious diseases will need to be excluded or treated.
- Current tests are not heat stable (Jorgensen et al. 2006; Chiodini et al. 2007). This varies by test type, but all RDTs are at risk of deterioration and reduced sensitivity when they are exposed to heat or humidity for prolonged periods, some becoming essentially useless over the course of just a few days when exposed to temperatures above 40° C. RDTs are commonly subject to high temperatures between leaving the factory gate and use in the field. Therefore, unless they can be deployed using a cold chain or made substantially more heat stable, they are poorly suited for use in Africa and other tropical areas where malaria is a serious issue.
- In high throughput settings, the cost of RDTs, most of which retail at around 60 cents per test, are substantially higher than light microscopy and therefore less cost effective than microscopy.
- Sensitivity and specificity in placental malaria in pregnancy has not been determined (Mockenhaupt et al. 2006; Uneke 2008).
- HRP2-based RDTs may show positive results for days to weeks after an effectively treated episode of malaria because of persistent circulating antigen. This reduces their specificity in settings where malaria is common and could lead to other febrile illnesses being misdiagnosed as malaria on the basis of a genuinely positive test but a false-positive one in clinical practice (B. Nadjm, personal communication) (Mayxay et al. 2001; Tjitra et al. 2001; Singh and Shukla 2002; Swarthout et al. 2007).

Three of these disadvantages may be overcome by technological advances. Heat stability has the potential to improve, and attempts by WHO to provide a systematic lot-testing system is a financial incentive for companies to maintain their manufacturing standards beyond the period when the tests are being assessed for initial deployment (http://www.wpro.who.int/sites/rdt). Second, it seems likely that quantitative tests will be deployed in due course, which will allow differentiation between high and low parasite counts, but this is still some years away. Such technological advances are unlikely to reduce costs and may well increase them. Third, it seems probable that, as the technology matures, costs will

decrease over time, but it is improbable that in high transmission, high throughput settings RDTs will ever exceed the cost-effectiveness of accurate microscopy.

Without doubt, however, the existence of RDTs has revolutionized the possibilities for parasite-based diagnosis beyond the hospital (or even clinic) setting. It may even have a role in hospitals and other higher-level facilities where light microscopy is not reliable or during off-hours.

One fact frequently forgotten as a practical issue is that RDTs still require blood to be drawn. The safety of deploying lancets for repeated fingerpricks in nonformal health-care settings where HIV prevalence is high (much of Africa, particularly Southern Africa) or hepatitis B is common (also Africa, particularly West Africa, and many parts of Asia) is an important consideration in discussions of RDT deployment outside the formal health-care sector. Noninvasive diagnostic tests, such as using urine or saliva, have been proposed but are not currently near deployment. They may never reach that stage and plans should not be made on the assumption that they do.

What Is Relevant for AMFm?

If AMFm is approved, the ACT expansion it will lead to will occur in the peripheral, informal, and private sector (meaning small unregulated shops). Microscopy will, for reasons outlined, continue to play little role in this sector in Africa. The choice will therefore be between continuing with clinical diagnosis (as with chloroquine), and deploying RDTs as well as the ACTs. Here we outline behavioral issues on how diagnostic tests are used in clinical practice. First, though, we need to answer four questions about the technology.

- Could deploying RDTs lead to a reduction in correct treatment of true malaria cases because of false-negative test results? This depends, critically, on consistent manufacturing quality, test robustness under typical transport and storage conditions, and correct test performance by end users. In principle, syndromic treatment should be almost 100 percent sensitive but very nonspecific. In practice, however, it is as often applied unsystematically. The 100 percent sensitivity is thus theoretical, but diagnostic tests may improve it.
- Can deploying RDTs be made safe from the risk of increasing transmission of bloodborne infections, especially HIV and hepatitis B? This will depend on adequate training in safe blood taking, a free supply of gloves and lancets (eliminating the incentive to use either twice), and a reliable method for safe disposal of sharps.
- Is there a financial incentive to shopkeepers and others to use rapid tests, if they are available, and, if not, can incentives be devised if it is thought desirable?

If the answer to the first question is yes, or the answer to the second or the third is no, the deployment of rapid tests alongside AMFm is unlikely to be advisable even if the considerable behavioral challenges outlined can be addressed.

How Diagnostic Tests Are Used in Africa and Asia

It is well recognized that the majority of children and pregnant women with malaria do not access formal health care, (Breman 2001) and typically are either not treated with an antimalarial or treated with an ineffective one. It is the second problem that the AMFm seeks to address. The probability is high that before children and adults receive formal health care they will—despite having malaria—not

receive an antimalarial. The probability is equally high, however, that once they do receive the care, they will receive an antimalarial regardless.

The majority of the information we have on diagnostic targeting of antimalarials to people with malaria comes from the formal public sector (hospitals and clinics), rather than peripheral dispensaries and the various elements of the private and informal sector where the AMFm is likely to have greatest impact. Some degree of extrapolation is therefore necessary. Extrapolation, however, carries risks: behavior in one segment of the health-care system (broadly defined) may be very different from others. With this caveat in mind, a number of studies in Africa have looked at variations on the question of what proportion of children and adults given an antimalarial has actually had malaria. The answer has been consistent: overtreatment of children and especially adults with antimalarials is substantial. Overdiagnosis is defined as giving an antimalarial to a patient who does not have any malaria parasites detected on a malaria test the clinician has requested. This is true for severe disease as well as for nonsevere disease, but this review concentrates on nonsevere disease because it is most relevant to AMFm.

The picture that emerges from the literature across Africa is clear: clinicians almost invariably respond to positive malaria tests by prescribing antimalarials, but often respond to negative tests by ignoring them and prescribing antimalarials anyway. When diagnostic facilities are available, half or more of those with negative test results are still treated for malaria (Hamer et al. 2007; Reyburn et al. 2007; Zurovac et al. 2008). When diagnostic facilities are not present, the proportion is even higher. Where malaria is common, most of those given an antimalarial actually have malaria parasites but a significant minority does not. In the many settings when malaria is not the predominant cause of febrile illness, that is, fewer than 10 percent of children presenting with fever have malaria parasites, the proportion of negative tests treated stays the same but the absolute numbers of those with a negative test treated with an antimalarial increase substantially. In low transmission settings, more than 90 percent, and in very low transmission settings more than 99 percent, of children treated with an antimalarial do not have malaria, despite tests being available (Ndyomugyenyi et al. 2007).

There is little doubt that this situation has not been helped by the ambivalent and potentially confusing message from WHO, and subsequently from national malaria control programs, that it is important to perform diagnostic tests for malaria in children under five in high transmission settings, and that if the clinician thinks a child has malaria, the child should be treated for malaria regardless of the test result (WHO 2006). This has also been interpreted as a need for blanket treatment of malaria in all children with fever. It must be noted that the term *high transmission* is not further defined in these guidelines. In true high transmission settings, when the majority of febrile illness in young children is malaria, this approach is safe, provided antibiotics are also considered. However, empiric treatment becomes problematic when this logic, which is explicitly meant only for high-transmission settings, is applied across the continent regardless of malaria incidence, almost all clinicians supposing their region to be a high malaria transmission area. Nursing and medical curricula may contribute to this impression. The true epidemiological situation in Africa is of course much more complex than this. In many areas, such as highland and some urban areas, malaria transmission is low or even nonexistent and has been so since records began. In other areas, transmission appears to be dropping significantly. The issue, then, is far from trivial.

Recent data from African settings without facilities for diagnosing malaria are currently sparse, but unsurprisingly find the same pattern of overdiagnosis (Olivar et al. 1991; Sowunmi and Akindele 1993). Inevitably, however, evidence of misdiagnosis in both directions is also greater, with true cases of

malaria being missed. Because malaria symptoms are nonspecific, especially in the early stages, only a diagnostic strategy that treated every unwell child as for malaria could be guaranteed to miss no cases.

Remarkably few equivalent data from the formal health-care sector in Asia are available, possibly in part because of an assumption that, because malaria is much less prevalent, it is much less likely that it is overdiagnosed. Such an assumption may well be false. A recent study in India, in an area with a relatively low endemicity for malaria, for example, demonstrated substantial overdiagnosis. Because the population of India is greater than that of malaria-endemic Africa, this finding is not trivial if it is consistent with practice elsewhere in India. Our empirical observations suggest that the same may well be true in Pakistan and Afghanistan at least, but we are aware of no published or unpublished data to support or refute this.

In summary, evidence of overdiagnosis of malaria in the formal health-care sector in many parts of Africa is clear, and what evidence there is from Asia suggests a problem there as well. Even when clinicians have tests and choose to use them, they often ignore the results. We are not aware of comparable data from Central or South America. The cost-effectiveness of RDTs erodes rapidly if negative tests for malaria are ignored (Lubell et al. 2008; Lubell et al. 2008).

Do RDTs Change Prescribing Behavior?

The purpose of a test is to change diagnostic and treatment practice. With RDTs and microscopy, we now have tools that provide accurate and relatively rapid results to guide case management. Do prescribers respond to the provision of RDTs by changing diagnostic decision making? The answer from a number of recent trials would appear to be either no or not very much.

Two studies from Africa, one a randomized control trial and the other a major observational study, have recently been published (Hamer et al. 2007; Reyburn et al. 2007). We are aware of at least two other trials for which abstracts are available. These data are backed up by a number of observational studies (Chandler et al. 2008; Zurovac et al. 2008). All seem to suggest, first, that clinicians often fail to request a diagnostic test when it is clinically appropriate, and, second, that when a test result is obtained, clinicians ignore both microscopy results and RDTs.

In the two published studies, which were conducted in several epidemiological settings (one in Tanzania and the other in Zambia), approximately 99 percent of patients with a positive diagnostic test (either microscopy or RDT) and approximately 50 percent of those with a negative RDT were prescribed an antimalarial. When only 1 percent of all febrile illness is malaria, the great majority (more than 90 percent) of all antimalarials prescribed were given to patients for whom the clinician had chosen to undertake a test, had received a negative result, and had prescribed an antimalarial regardless. The impact of negative RDTs on increasing antibiotic prescribing was slightly greater but certainly not startling. Comparing microscopy with RDTs in this randomized trial demonstrated that the two tests were treated almost exactly the same, with no greater credence given to RDT results.

Of the studies reported at meetings in abstract form only, an observational study in Zambia found a similar pattern, though negative RDT results were respected more often than negative microscopy results.

All the studies reported here provided a half-day or one-day training package, designed to be realistic in terms of what a national malaria control program could deliver across a country, focusing on details of

RDT performance, and typically with a brief review of national case management guidelines. The results of more intensive training efforts on health worker prescribing behavior in Uganda are encouraging. A one-week integrated course for health workers at facilities with microscopy significantly decreased unnecessary ACT prescriptions (Ssekabira submitted for publication). In addition, preliminary data from an evaluation of an RDT training course targeted to workers at peripheral health facilities, which included clear guidelines on management of patients with positive and negative RDT results, dramatically decreased unnecessary antimalarial prescriptions while maintaining satisfactory patient outcomes (Heidi Hopkins, unpublished data). It remains to be seen whether these more intensive training programs can be taken to national scale in endemic countries.

To improve the use of diagnostic tests, we need to know a great deal more about why clinicians prescribe in the patterns described. Investigation is only just beginning, but initial data from Tanzania provide fairly clear indications (Chandler et al. 2008). One reason Tanzanian clinicians frequently gave was that patients expected this overprescription, but observational and anthropological studies demonstrate that this belief is incorrect (Chandler et al. 2008). Patients attending outpatient settings stated fairly clearly that if they wanted an antimalarial they would simply buy one, and that they come to formal health-care settings for a diagnosis. Clinicians appeared to make diagnostic treatments of malaria on the basis of complex mind-lines involving a mixture of conventional clinical logic and diagnostic algorithms on the one hand, and social factors with no obvious basis in clinical logic on the other. They also use tests to confirm their suspicions, rather than as a way to make a diagnosis or allocate treatment. Because malaria is the most common diagnosis outpatient clinicians in Africa make, leading to an ingrained process reinforced every working day, evidence from other settings (e.g., antibiotic prescribing in the UK and United States) suggests that changing behavior will not be straightforward.

What Is Relevant for AMFm?

Are these data helpful in assessing the potential impact of RDTs in the settings where AMFm would expand ACT access? Yes and no. The key points are that just because tests are available and used does not mean that they will change prescribing behavior, and that the theoretical effectiveness and cost-effectiveness of RDTs may be much higher than their actual effectiveness and cost-effectiveness. The data cannot be used directly to predict how shopkeepers and peripheral dispensers would use RDTs. It would not be sensible to deploy RDTs as part of AMFm except with a strong operational research component in pilot studies to assess the impact in practice. There is at least a possibility that shopkeepers and others may be more likely than doctors and clinical officers to respond to the results of diagnostic tests.

The Situation in Asia

Although not the main focus of AMFm, the situation on diagnosis in Asia is even more complex than in Africa. The vastly different epidemiological settings across the continent, the co-endemicity of two species of malaria (vivax and falciparum) in varying proportions, and the scarcity of data on which to base policy contribute to this complexity. The number of settings where malaria endemicity is as high as Africa is relatively small but includes Papua New Guinea and parts of Indonesia, Assam in India, and Yemen. Elsewhere the incidence is generally far lower, though the large total populations make the sheer numbers of malaria cases substantial and the numbers of febrile cases in malaria-endemic areas vast.

There are concerns about the delivery of ACTs in most of Asia, where access remains low and, where it is available, ACTs are not rationally prescribed (Joshi et al. 2008). Worryingly, recent evidence from Cambodia indicates that empiric over-the-counter treatment with artemisinin monotherapies is common and of long standing (Yeung et al. 2008) and that this is associated with detection of reduced parasite susceptibility to artemisinin drugs. In addition, the level of counterfeit and substandard drugs is high, which reduces treatment effectiveness, may propagate resistance, and undermines public confidence in the treatments. In these areas, the attributable fraction of febrile illness due to malaria is low, and the importance of targeting ACTs to the right cases is considerable.

In many parts of Asia, and in particular in South Asia, the dominant parasite species is vivax malaria. The cost-effectiveness of RDTs as estimated for falciparum malaria is likely to decrease substantially for vivax malaria, though there are fewer models for the vivax strain. This is partly because vivax malaria is less likely to lead to loss of life, partly because the drugs effective against vivax are themselves much cheaper, and partly because the tests that reliably diagnose vivax malaria are generally more expensive than those that reliably diagnose only falciparum malaria, and sensitivity to nonfalciparum malaria remains a challenge.

Light microscopy has an advantage when vivax and falciparum co-exist, but the advantage depends on greater training for microscopists, in that they need to be able to differentiate between the species as well as simply to diagnosis malaria and then to quantify it. One approach is to treat all malaria with ACTs but when only a small proportion of febrile cases are malaria, and of these 90 percent are vivax malaria, addressing the problem is relatively expensive. In most areas, ACTs will provide no additional benefit in terms of cure of acute vivax episodes, reducing vivax gametocyte carriage (Kolaczinski et al. 2007), and are unlikely to eliminate hypnozoites, thus have no additional advantages over chloroquine. Emergent drug resistance to chloroquine may change this dichotomy to a unitary treatment with ACTs, though the switch, if it occurs, is some time away.

When falciparum is the major species, treatment of all malaria cases with ACT will be more cost-effective than when vivax is. However, when vivax is the major species, falciparum will be treated more frequently with (potentially ineffective) drugs unless accurate diagnosis is available.

Clearly there is a central role for diagnosis in Asia, but what form this could and should take requires careful evaluation. Prescriber practices and the role of diagnostics in Asia receive less attention than the sensitivity and specificity of RDTs (Kolaczinski et al. 2004; Bharti et al. 2008). The role of the private sector in Asia is understudied as well and at best speculative. This lack of data, coupled with the complex array of epidemiological settings, makes it more difficult to reach conclusions on the role of RDTs in the region. Logically, of course, RDTs do have a role, and many governments are seeking to bring RDT use to scale despite the lack of evidence of any advantage over microscopy or even presumptive treatment.

Our view is that further research in Asia is necessary before RDTs are deployed in general health services, and before any part of any AMFm is extended there. We have no way of predicting reliably what the impact of either would be on prescribing practices, and the number of tests that could potentially be used in this setting is vast, with consequentially significant costs.

Conclusions

1. Improving diagnosis of febrile illness so that effective antimalarials are targeted to those with malaria should be a priority, but there are no quick fixes.

2. Microscopy remains an excellent technology, but is unlikely to be relevant to the peripheral settings where AMFm would make a difference.

3. There are sensitive and specific RDTs, and these could be used in the periphery, but technical questions over heat stability, operational safety, and financial incentives for use are significant concerns.

4. RDTs can be cost effective over a wide range of epidemiological settings—but only if their use leads to changes in prescribing.

5. Overdiagnosis of malaria is substantial in the formal health-care sector throughout Africa, and very possibly in Asia, based on clinical symptoms alone.

6. Evidence that deploying RDTs with a limited training package will change the prescribing behavior in the formal health-care sector is disappointing. Changing prescribing behavior will be challenging. This may or may not be relevant to the sectors where AMFm will have impact.

7. The low incidence of malaria and high proportion of vivax malaria complicates the diagnostic picture in Asia, and we have relatively little data on diagnostic and prescribing practices there.

8. The importance of diagnostics increases as the incidence of malaria, and thus the prevalence of malaria in febrile children, decreases. This is likely to be particularly important for the later phases of the roll-out of AMFm.

We believe that AMFm will have to take diagnosis of malaria, and febrile illness more generally, into account if it is to have the maximum impact and remain sustainable and acceptably cost effective, but that this is likely to be more important in later stages as the roll-out occurs in areas with lower transmission (or as transmission in first-phase countries drops). In Africa, a number of actions can be taken now, and in the wings are a number of interventions on which data will soon be available to help guide policy. In Asia, substantially more information is needed before any recommendations can be made.

What would need to be undertaken depends on the setting, which we divide broadly into formal health-care outpatient settings where microscopy is available; formal health-care settings where microscopy is not available (most clinics in Africa); the private sector, subdivided into the formal health-care sector and small unregulated shops; and community drug distributors, such as in home-based management of fever (HBMF) programs.

Within the formal health-care sector, in hospital settings where microscopy is available, the priorities are clearest because the evidence base is best. The need to increase the proportion of febrile children and adults tested for malaria, and then to reduce the overprescription of antimalarials to those with negative tests, is clear. This can only happen, however, when diagnostic facilities have been improved. This may be achieved by maintaining microscopy standards and materials or, if this proves impractical, by supplying RDTs. The key, however, is not in technology, but in attitude and behavior change amongst clinical prescribers. The formal health-care sector is however not one likely to be important for AMFm; the Global Fund already provides subsidized ACTs in this setting to most endemic countries.

In the formal sector where microscopy is not available, such as in clinics, it seems pretty clear that some diagnostic facilities would be an improvement on no diagnostic facilities and that deploying RDTs is likely

to be the only practical solution in most settings. Ongoing research is needed to assess the impact of RDT implementation on actual prescribing behavior and, in all probability, complex behavioral interventions as well.

Using RDTs in the formal private sector seems an entirely rational choice, but a relatively small proportion of the target beneficiaries of AMFm also use the formal private sector. Those who do are at relatively lower risk of malaria than other groups given that, in most African and Asian countries, malaria is primarily a disease of the poor and of those in rural communities.

The largest unknown area, which offers the greatest potential gains, is the informal private sector, such as general shops, specialized pharmacies, and chemical sellers. Users of this sector are often the poorest and the most likely to be affected positively by the AMFm. Massive overprescription of antimalarials in this sector could significantly reduce sustainability of the AMFm system. We do not yet have information about how RDTs would be used in this sector, though some studies are under way. It is essential that deploying RDTs neither decreases the number of people with true malaria treated with an antimalarial (e.g., false-negative results), nor increases the proportion of people treated for malaria who do not have it (meaning they might die of other causes), significantly increases the risk of transmission of blood-borne viruses. This last element is particularly important. It would be a serious setback from a public health point of view if, in promoting better diagnosis of malaria, we also promote increased transmission of HIV of hepatitis B. This is not a theoretical risk: the temptation for shops which are working on small profit margins to re-use lancets may not be trivial. The safety of the shop-keepers should also be considered, given the small but real risk of needle-stick injuries. How to provide proper incineration of shop-used lancets would be another important operational question. Changing shopkeeper behavior is possible but requires intensive piloting and adapting to local conditions (Marsh et al. 1999). In our view, therefore, deploying RDTs in this setting without thoughtful operational assessment of safety and effectiveness would be premature and potentially even dangerous.

In considering RDT use by community volunteers, such as in HBMF programs, the same concerns apply. Some promising early work has been done to evaluate the implementation of RDTs in Zambia's HBMF program, and evidence should be forthcoming within the next year or two (Harvey et al. 2008).

In the longer term, and as malaria decreases in some settings, leading to a reduction in the proportion of children with febrile illness presenting with malaria, we may need to consider, at least in some settings, syndromic management of fever with a combination of antimalarials and antibiotics. Although clinicians already use syndromic treatment to some extent in individual cases where the diagnosis is in doubt, deploying it on policy to all febrile children is some way in the future and would meet substantial resistance. Concerns about drug safety and the promotion of antibiotic resistance are legitimate. For the moment, however, the choices are between improving and not improving diagnosis, and in that choice the overall goal must be clear. We now have the technology to make a proper malaria diagnosis, and though diagnosis is continuing to improve, the biggest stumbling block continues to be behavioral change rather than technological problems.

The AMFm provides a remarkable opportunity to improve the whole management of febrile illness in Africa. This will require operational research alongside deployment but, if undertaken properly, could have positive ramifications for all the other causes of febrile illness and thus reduce mortality beyond the malaria-attributable fraction that the AMFm is addressing directly.

Table 1. Advantages and disadvantages of different diagnostic test methods.

Diagnostic Method	Advantages	Disadvantages
Light microscopy	• Provides additional diagnostic information: quantification of parasite density, identification of parasite species, assessment of hematological abnormalities, identification of certain other infectious agents if present • Useful for monitoring response to treatment • If quality maintained, likely cost advantage over other diagnostic methods (RDTs and empiric treatment) where patient volume is high	• Reliable results require well-maintained microscopes, reagents and supplies, as well as electricity (or strong sunlight) • Need for skilled and motivated laboratory personnel • More time-consuming and labor-intensive than other diagnostic methods (RDTs and empiric treatment)
Rapid diagnostic tests (RDTs)	• Relatively simple to use, can be performed by health workers with limited formal training • Do not require special equipment or electricity • Likely cost advantage over other diagnostic methods (microscopy and empiric treatment) where patient volume is relatively low	• Give only "yes or no" information on parasitemia; not quantitative • Susceptible to degradation and loss of sensitivity when exposed to high temperatures and humidity
RDT: HRP2 (histidine-rich protein 2)	• Sensitivity maintained at lower parasite densities • Relatively stable in typical storage conditions in endemic areas (though may vary by manufacturer, etc)	• Detects *P. falciparum* only (some tests combine HRP2 detection with pLDH or aldolase detection to allow diagnosis of non-falciparum species as well) • Antigenemia persists post-treatment, which precludes use to monitor treatment response, and may lead to false-positive results in areas of intense transmission
RDT: pLDH (plasmodium lactate dehydrogenase)	• Detects *P. falciparum, P. vivax, P. ovale,* and *P. malariae* (some pLDH-based tests can distinguish *P. falciparum* and *P. vivax* from other species) • Consistently mirrors parasitemia, so can be used to monitor treatment response	• Sensitivity drops at lower parasite densities • Less stable at typical storage conditions in endemic areas

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AMFm: Reaching the Poorest of the Poor with Effective Malaria Drugs

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Executive Summary

The AMFm initiative is expected to increase the availability and consumption of new and effective antimalarial drugs known as ACTs by lowering their end-user prices to the range of $0.20 to $0.50 per treatment course, down from the current $8 to $10. This reduction will result from a global buyer copayment of ex-manufacturer prices that AMFm will put in place. The lower price of ACTs will equal that of alternative yet less effective antimalarial treatments, such as chloroquine (CQ) and sulfadoxine-pyrimethamine (SP). It is hoped that the initiative will increase the demand for malaria treatment and the share of ACT treatment among those demanding malaria care. Promoting such changes will require a number of interventions, however, such as education, promotion, and suggested retail prices, in addition to a reduction in the price of ACTs.

Nearly 75 percent of all malaria treatments in afflicted countries are currently sold through the private sector (health-care providers, pharmacies, and shops), and only 25 percent are delivered through public providers. In the private sector, ACTs are a marginal source of treatment, representing only 5 percent of all consumption. The relatively high price of ACTs—nearly 20 times greater than that of CQ or SP—is a key factor behind this. In the public sector, ACTs represent 65 percent of all antimalarial treatments prescribed; this much greater share is a consequence of a greater availability of the new drug among public providers, of their promotion of this treatment, and of the fact that they sometimes give these new drugs at no charge to patients or at a lower than market price.

A particular concern of those designing the AMFm initiative is that the prices of even subsidized ACTs may be too high for the poorest stratum of society. Relatively low consumption by the poor of conventional antimalarials such as CQ and SP, currently sold for $0.50 or less per adult treatment dose, suggests that an additional end-user subsidy may be required to lower the economic barriers to consumption by the poor even more to enable financial access to ACTs.

The objective of this paper is to review the existing policy options to lower user prices of ACTs below the $0.20 to $0.50 range. Specifically, the assignment was to review price subsidy policies used within and outside of the health sector to increase consumption by the poor of health care, basic services, food, and other commodities.

Subsidizing end-user prices of ACTs for the poor presents different challenges than does subsidization of food, commodities or other social services for the following reasons: 1) uncertainty about the need for malaria treatment; 2) externalities in the consumption of ACTs; 3) predominance of private commercial channels in the supply of antimalarials; 4) limited knowledge among the general population and specifically among the poor about the private benefits of ACTs; 5) low benefit amount for a subsidy for ACTs –annually, about USD 2.00 per person; and 6) imperfect information among consumers about the quality of antimalarials, including ACTs.

In this paper, we review selected literature on the demand for antimalarials in Africa and Asia; discuss options for subsidizing ACTs, review the targeting methods and subsidy amount of targeted programs in developing countries, examine in detail the mechanics and performance of a variety of targeted programs in the social sector delivering benefits with low dollar values, which would be similar to an ACT end user price subsidy beyond AMFm. The following list summarizes our main findings.

Patterns of use of antimalarials. Information from Demographic and Health Surveys carried out in several developing countries show the following:

- Better off individuals are considerably more likely than the poor to obtain ACTs, spend more on malaria treatment in the private sector, and are probably more likely to obtain adequate treatment for malaria.
- In Tanzania, government providers are selected equally by all socioeconomic groups as a source of treatment for fever/malaria, whereas NGO providers are selected more often by the better off.
- Use of preventive measures against malaria, such as insecticide-treated nets (ITNs), indoor residual spraying, and prophylaxis during pregnancy are considerably higher in the top socioeconomic group than in all other groups, where utilization rates tend to be somewhat homogeneous.
- High use rates of preventive maternal and child services in low-income countries offer the prospect of promoting demand for ACTs among mothers, including the possibility of distributing vouchers for free or subsidized ACTs.

Options for the subsidization of end user prices of ACTs. Many options are available to provide an end-user subsidy for ACTs, both targeted and untargeted. Country and local circumstances will determine the most appropriate option in each case. Some of the alternative options discussed in this section are as follows:

- *An untargeted, universal price subsidy at the point of delivery.* This type of subsidy can be partial or total, resulting in zero or low prices, respectively. ACTs are already provided to the public sector in clinics and other health care facilities through donors. In some countries, treatment for malaria, including ACTs, is provided free and in others, for a consultation fee that is usually much less than the retail cost of ACTs. In the private sector (private providers, pharmacies, shops), such a subsidy would require significant amounts of additional financing. It is likely that an untargeted price subsidy in the private sector would result in fraud and waste of ACTs. Control mechanisms would be needed to make this system viable and efficient. Vouchers would be necessary to reimburse private providers for the portion of their price that would not be covered by any user co-payment.
- *A targeted subsidy for the poor at the point of sale/delivery*. This type of subsidy could also be partial or total and could be implemented in both the public and private sectors. Implementing such a subsidy is difficult because of the need to identify the poor. ACT subsidies could piggyback on other subsidies for the poor, using existing beneficiary identification systems. This type of system would likely require vouchers, with the same problems as discussed above. Examples of such targeted systems exist, but they have not been universally successful.
- *A conditional price subsidy*. A subsidy could be provided to poor individuals who engage in specific, socially desired behaviors, such as the use of preventive health care or enrollment of children in school. This brings the challenges of beneficiary identification. ACTs to keep at home could be distributed to mothers (all or only poor) seeking preventive obstetric care and child growth monitoring or vaccination services. They could be educated about ACTs at the same time. The literature offers some examples of targeting systems of this sort, but seldom with good targeting outcomes, except for conditional systems with a narrow beneficiary base, such as clinics for sexually transmitted diseases.

- *Price subsidies assigned through geographic targeting*. They offer a good solution where there are regions (villages, entire regions) that are predominantly poor. Systems of beneficiary identification are unnecessary but vouchers and controls are still required if the private commercial sector is to remain the source of ACTs. The literature offers several successful examples of this kind of targeting.
- *A targeted subsidy at the point of sale for all customers who self-select (targeting by self-selection).* ACTs could be provided for free in places visited mostly by the poor, such as certain markets, work-related or social events. Such opportunities may not exist everywhere, and free distribution of ACTs may draw non-poor individuals as well.
- *A targeted subsidy intended for the poor who predominantly demand a specific service (targeting by type of service).* This is also an option where those demanding a specific service are predominantly the poor. Examples exist in Latin America; we are unaware of such situations in Africa and Asia, but if they exist, they could be used for this kind of targeting.
- *Cash transfers.* These are income supplements provided in cash or near cash (such as coupons and vouchers) to the poor. Given the irregular and unpredictable occurrence of malaria episodes, cash transfers do not seem an appropriate targeting mechanism for ACTs; recipients may spend the cash on other imminent needs.

The value of an additional subsidy for ACTs, beyond AMFm, would be relatively low, on the order of $2 per person per year, but costs of delivering the benefit might be quite high. The social safety net programs that we reviewed report benefit levels that tend to be much higher than the expected benefit of an ACT price subsidy. We found the following:

- food transfer and other food-based programs deliver annual benefits that range from about $8 to $176, with an average benefit size of about $47;
- conditional cash transfer programs, which deliver food, education, and cash benefits conditional on child school attendance or other behaviors, deliver annual per capita benefits ranging from $0.4 to $153, with an average benefit size of $24;
- fee waivers for health and education provide annual benefits in the range of $3 to $85 with an average of $33.

Mechanics and performance of targeted and untargeted subsidized programs delivering benefits that are small in dollar value. Subsidized programs in family planning use a variety of approaches. Some are targeted, some not; some deliver benefit levels comparable to subsidized ACTs, others have much higher benefits. Experience in this area may offer useful lessons for the subsidizing of ACTs. A relevant example is the Brazilian government's recent announcement of a general subsidy for oral contraceptives (OC) through private drug stores, a main source of health care and contraception for the poor. Each subsidized OC package, with a monthly supply that now retails for $2.56 to $25.60, will carry a price of $0.20. Anyone, rich or poor, will be able to buy the pills with a government-issued identification card that almost all Brazilians carry.

Transferable vouchers targeted to specific population groups. A system of transferable vouchers in Nicaragua to promote preventive, curative, and family planning services was targeted to adolescents and commercial sex workers. It led to a two-fold increase in the use of health care and family planning services among beneficiaries. The cost per voucher redeemed was $41.

- *Subsidized programs for malaria prevention.* In Tanzania, geographic targeting was used to select impoverished semi-urban and rural areas with high malaria incidence for ITN

distribution. Another program in Tanzania used categorical targeting to deliver ITNs to low-income children in rural districts. Another program in the same country handed out vouchers for subsidized ITNs to a target group of pregnant women and mothers with children under 5.

- *Targeted food programs.* The review also included examples of targeted food programs. In the Philippines, low-income villages were targeted on the basis of reported malnutrition status. Implementation required a sophisticated system of controls. A program in Peru relied on two-stage targeting: geographic targeting to poor localities and community targeting within localities to distribute milk, milk substitutes, cereals, and other commodities. A targeted bread subsidy in Egypt relied on self-selection to deliver subsidized bread.

We have concluded the following:

- It is not possible to say at this point the extent to which AMFm, with its $0.50 end user price, will make ACTs broadly available to the poor and the poorest of the poor. Early evidence from pilot programs (Sabot et al. 2008) lead to cautious optimism. Whether or not further, targeted or untargeted subsidies will be necessary is an empirical question that remains unanswered.
- The $0.50 retail price that will be made possible through AMFm may still result in inadequate access to ACTs among lower socioeconomic groups. One DHS survey shows that the poor tend to spend as little as $0.05 on antimalarials in the private sector. The need to consider additional, end user subsidies to lower the price of ACTs below USD 0.50 seems justified.
- Many subsidy programs are available for commodities in different sectors (cooking oil, sugar, bread, bed nets, and contraceptives). Few, however, deliver benefits as low as the expected benefit amount of an ACT end-user subsidy program.
- Some of these programs have been successful in improving access to commodities, but not always to the poorest.
- Many programs rely on private commercial channels, from wholesalers to retailers to community leaders.
- Some programs attach to other high coverage programs (example from Zambia: distribution of ITNs for malaria prevention through public health providers during vaccination campaigns).
- These programs use a variety of targeting mechanisms. Some are universal nationwide (e.g., oral contraceptives in Brazil), some rely on self-selection (bread in Egypt), and some are universal in geographically targeted areas (cooking oil and rice in the Philippines).
- Means-tested programs tend to have high administrative costs and therefore are not common for subsidizing low-cost commodities.
- Programs that rely on private commercial channels must necessarily convey economic incentives to induce private participation.
- Where well-developed private commercial channels are lacking, subsidized programs may have to rely on public providers (ITNS in Mozambique).
- In areas that would initially be outside the reach of AFMm, targeted subsidies, e.g., with vouchers, might increase the use of ACTs sold via private retailers.

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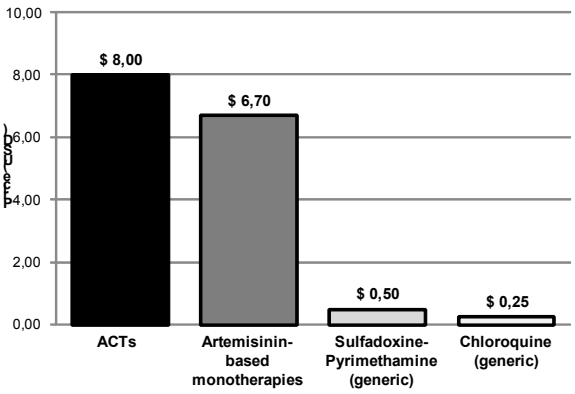
AMFm Initiative and Policy Challenge

Malaria is the eighth highest contributor to global disease, as measured in disability-adjusted life years (DALYs), and the second largest in Africa. One-third of the world's population, about 2.1 million people, are at risk of contracting this disease. Annually, there are approximately 500 million malaria cases in the world, of which 90 percent are in Africa.

In the absence of a malaria vaccine, the fight against malaria takes the form of a series of preventive and curative interventions, and malaria elimination remains a distant goal in most endemic areas. Prevention includes the control of epidemics, the use of insecticide treated nets (ITNs), and chemoprophylaxis for pregnant women. Curative measures consist of the prompt and effective treatment with antimalarials. Early diagnosis is essential to improve treatment effectiveness and cost-effectiveness.

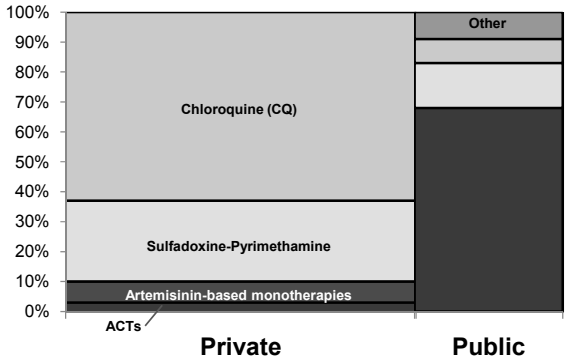
Figure 1. Indicative Prices of Malaria Treatments to Patients in Private Sector Retailers, circa 2005



Source: Roll Back Malaria Partnership (2007).

The challenge of controlling malaria is exacerbated by the growing resistance to traditional antimalarials such as chloroquine (CQ) sulfadoxine–pyrimethamine (SP), amodiaquine (AQ), and mefloquine (MQ). Fortunately, a new group an antimalarials known artemisinin-based combined therapies, or ACTs, has become available in the past decade. These compounds "produce a very rapid therapeutic response (reduction of the parasite biomass and resolution of symptoms), are active against multidrug-resistant *P. falciparum*, are well tolerated by the patients, and reduce gametocyte carriage (and thus the rate of malaria transmission). To date, no resistance to artemisinin or artemisinin derivatives has been reported, although some decrease in sensitivity in vitro has been detected in China and Vietnam. If used alone, the artemisinin compounds will cure falciparum malaria in seven days, but studies have shown that in combination with certain synthetic partner drugs they produce high cure rates in three days, and spur higher adherence to treatment by patients" (Roll Back Malaria Partnership 2007).

Figure 2. Sales Volume of Antimalarials



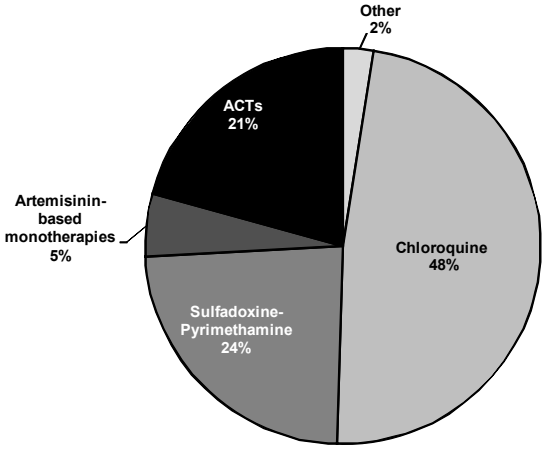
Source: Roll Back Malaria Partnership (2007).

An obstacle to the widespread consumption of ACTs in malaria-afflicted countries is the high private sector price of these drugs relative to the price of conventional alternatives. As shown in Figure 1, the average market price of an adult course of malaria treatment with ACTs among private providers, pharmacies, and shops, is $8.00. Drugs that are less effective and that promote resistance have lower market prices have lower prices. Artemisinin monotherapies are sold for an average price of $6.70 per

treatment, whereas the more traditional yet substandard monotherapies of SP and CQ have prices that are only a small fraction of ACTs prices.

Private prices matter a great deal because at the present time about three-fourths of all malaria treatment medicines obtained around the world—410 million treatments in 2006—get sold in the private sector (health providers, pharmacies, shops). Yet the sale of ACTs in the private sector accounts for only 3 percent of all antimalarial treatments there. Public sector malaria treatments amount to 25 percent of the total—150 million treatments in 2006. In the public sector, instead, ACTs come to more than 65 percent of all malaria treatments, but the high presence of this new drug among public providers has only a limited impact given the relatively small market share of public providers. Overall, combining private and public sectors, ACTs represent a mere 21 percent of all malaria treatments (Figure 3).

Figure 3. Sales Volume of Antimalarials in Public and Private Sectors, circa 2005



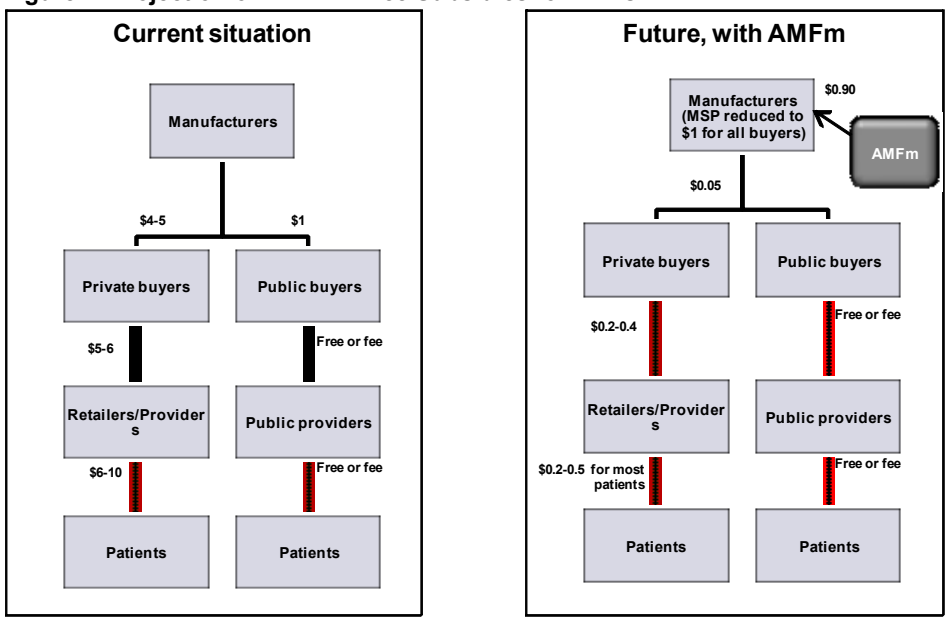
Source: Authors; data from Roll Back Malaria Partnership (2007).

The AMFm initiative is expected to increase the availability and consumption of ACTs by lowering their end-user prices to between $0.20 and $0.50 per treatment course, down from the current $8 to $10. This reduction will result from a global buyer copayment of ex-manufacturer price that AMFm will put in place (see current and expected situation with the AMFm initiative in Figure 4). The AMFm general price subsidy applied at the ex-manufacturer level will lower ACT prices to both public and private wholesalers to about $0.05 per adult treatment course, down from the current price of about $1.00. All the agents that intervene in the public and private commercial and distribution chains, from wholesalers to distributors to retailers, will in the new scenario purchase ACTs at the reduced price and add their margins when passing it on to the next level in the chain. The AMFm subsidy, worked out through both public and private channels, will finally result in a retail price of $0.20 to $0.50.

The lower price of ACTs will equal that of alternative yet less effective antimalarial treatments, such as chloroquine (CQ) and sulfadoxine-pyrimethamine (SP). It is hoped that the initiative will bring about an increase in total demand for malaria treatment and in the share of ACT treatment among those demanding malaria care. Promoting such changes will require a number of supporting interventions, however, such as education, promotion, and suggested retail prices, in addition to a reduction in the price of ACTs.

The AMFs initiative will be financed by donors and its total financial requirements are estimated to be in the range of $1.4 to $1.9 billion over five years. The buyer copayment and the distribution costs account for the majority of this amount, or between $1.2 and $1.6 billion. A core package of in-country supporting interventions is expected to cost between $230 and $330 million over five years. Finally, the administrative management of AMFs will cost about $25 to $30 million during the same period.

Figure 4. Projection on AMFm Price Subsidies for ACTs

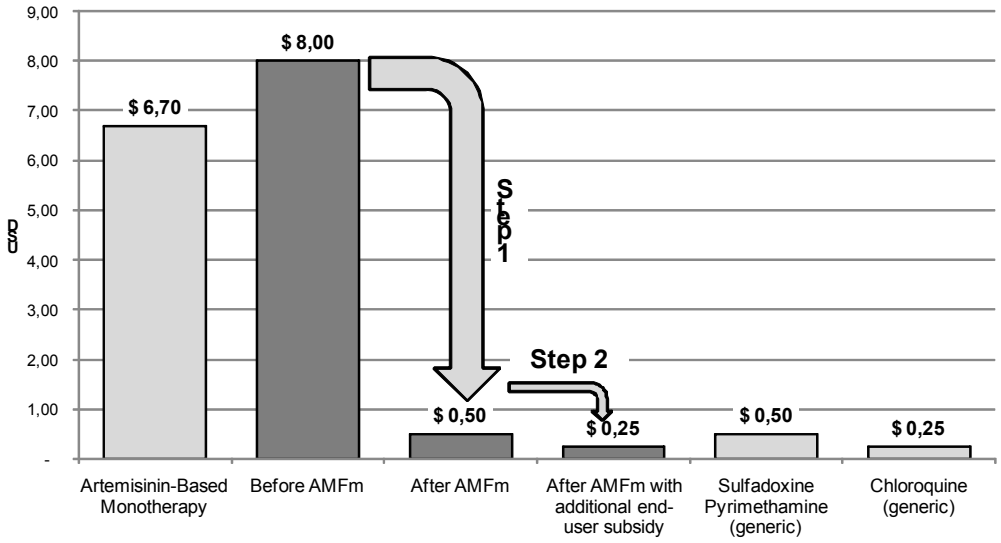


Source: Roll Back Malaria Partnership (2007).

The designers of AMFm expect that the drop in the price of ACTs will have a considerable impact on the demand for and use of these new drugs, more than tripling annual treatment courses from the current 110 million treatment courses to 360 million. They also expect that, by increasing total access to treatment and displacing substandard drugs, this initiative will bring about an estimated 174,000 to 298,000 lives saved per year, with an estimated cost per DALY of $33 to $56, making the AMFm a relatively cost-effective intervention.

Malaria affects a disproportionate share of poor people, children, and pregnant women. Children under five years of age account for three-fourths of all malaria deaths. Using results from a recent study, Somi and colleagues (2007) show that the burden of malaria falls disproportionately on poorer households. They report that poorer households bear a greater economic burden from malaria relative to their consumption than better-off households. Households are particularly vulnerable to malaria in the rainy season, when malaria prevalence is highest but liquidity is lower. Deressa and colleagues look at the experience of rural families in an area of epidemic malaria and conclude that “malaria poses a significant economic burden on rural households and individuals both through out-of-pocket payment and person-days lost” (2007, 1148).

Figure 5. Two-Step Subsidizing of ACTs, with Price Comparisons



Source: Adapted from authors from Roll Back Malaria Partnership (2007).

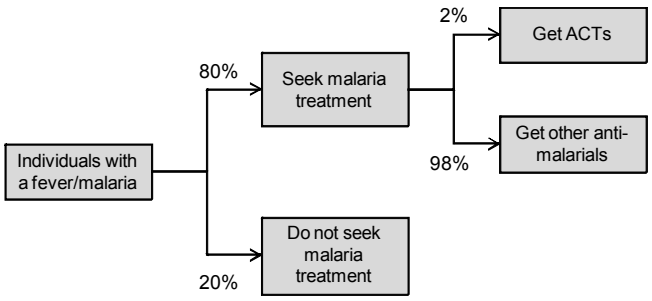
The AMFm price intervention amounts to a universal or general price subsidy. It is general because the subsidy will benefit all those who decide to purchase ACTs at the subsidized price. The substantial reduction will likely increase overall access to this treatment, but some fear that the reduced price may still be too high to enable the poorest of the poor to access this new and more effective treatment. Hence the idea of exploring the feasibility of adopting a targeted price subsidy that will further lower the market price of ACTs below the expected price of $50 resulting from the current design of AMFm.

It is thus conceivable to envision a two-step subsidization policy for ACTs, as in shown in Figure 5. At the first step, a universal or general price subsidy will be delivered. It will be the ex-manufacturer price subsidy that AMFm will implement and that is expected to result in a drop in the private market price from $8.00 to between $0.20 and $0.50. At the second step, an additional targeted subsidy would further lower the price of ACTs, both private and public. The challenge that this study was asked to address is the feasibility of implementing the second step targeted subsidy.

Health-Care Seeking Behavior: Empirical Evidence

Assessing the consumption of antimalarials and of ACTs in particular involves an analysis of three phenomena that intervene in consumer behavior: the perceived need for health care, the propensity to demand health care when there is a perceived need for it, and the actual use of the good or service once demanded. This section reviews selected literature about consumer behavior vis-à-vis malaria occurrence and treatment, and also about malaria prevention. Results from this review are used in subsequent sections of this report as an input in the analysis about the feasibility of introducing targeted subsidies for ACTs at the retail level.

Figure 6. Uganda: Health-Care Seeking Behavior, 2006



Source: Authors.

The Demographic and Health Surveys (DHS) have in recent years added a malaria module to their household questionnaires specifically to measure the perception of illness, demand and use. Findings from these surveys reveal different country circumstances, and also different circumstances within individual countries. However, a constant finding that emerges from these surveys is that the poor have a more limited access to malaria treatment in general, and that they have less access to effective antimalarials

Results from the DHS survey carried out in Uganda in 2006 are useful to illustrate this phenomenon. Nearly 80 percent of those individuals reporting a fever—often a symptom of malaria—sought health care and among them a high 98 percent obtained antimalarials (Figure 6). Whereas access to treatment was overall high, the kinds of treatment that people obtained varied.

A brief description of the malaria treatment policy in Uganda is first necessary to interpret the findings. At the end of 2000, Uganda's health authorities decided to change the first-line malaria treatment policy to chloroquine and fansidar (CQ+SP). This policy was officially launched in 2002, but the resistance to SP as well as CQ + SP continued to rise between 2002 and 2004. In 2004, the first-line treatment policy for malaria was changed to artemether–lumefantrine. To enable broad access to ACT in the private, for-profit sector, artesunate + amodiaquine was defined as an alternative first-line treatment. The roll out of the new policy began in February 2006 using the brand Coartem. Home-based management of fever was launched in 2002, starting with 10 districts, and covered the entire country in 2006. The treatment, called Homapak, is a combination of CQ + SP distributed in two age-specific color packages, that is, red for those age six months to two years and green for children age two to five years. Caretakers of children with fever access the treatment from volunteers at the village level called Community Medicine Distributors.

Table 1 shows a summary of malaria-related statistics from the Uganda survey. The reported prevalence of a fever in the two weeks preceding the survey (first column) was highest among the poor (e.g., 48.3 percent for the bottom quintile versus 32.3 percent for the highest). The consumption of any kind of antimalarial was constant across all quintiles, however, around 60 percent. Mono-treatment was by far the most frequent choice of antimalarial (around 75 percent), and even higher among those in the top quintile—a rather surprising finding given that such a treatment is the least effective. The consumption of the combined treatment of CQ+SP, which is generating growing resistance by *P. falciparum*, was relatively homogeneous among the 4 lowest quintiles, at around 20 percent. The consumption of ACTs was low overall, but individuals from better-off households were almost twice as likely to consume them as those in the bottom quintile. In summary, the poorest (bottom quintile) were more likely than other groups to report a fever and the second least likely to consume ACTs.

Table 1. Uganda: Prevention and Treatment for Malaria, 2006 (%)

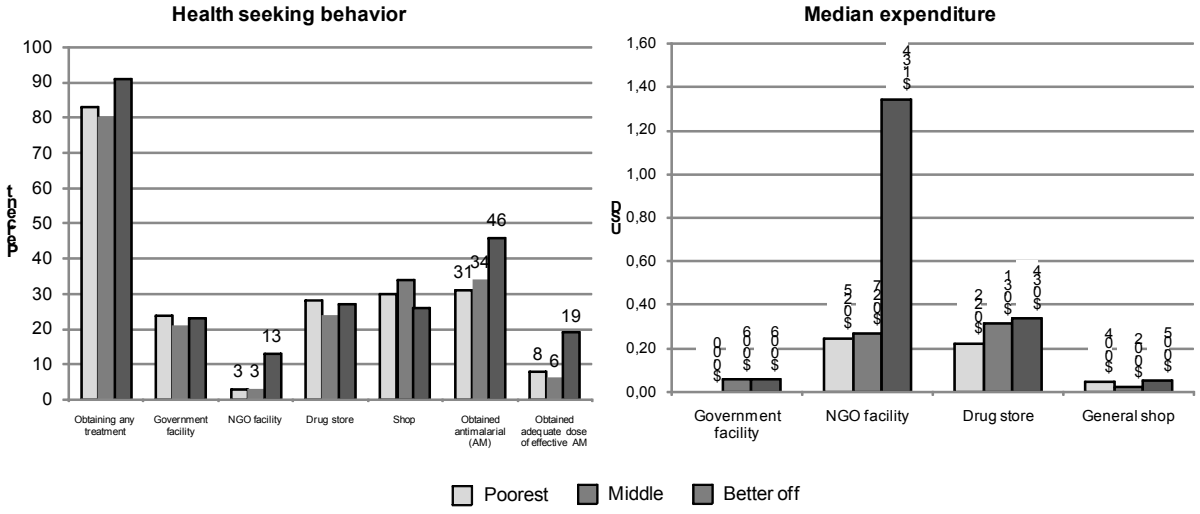
	Children under 5: fever and consumption of antimalarials		Type of antimalarial taken			Preventive measures			Source of mosquito net			
Socio-economic status (wealth quintile)	Reported fever in last 2 weeks	Took antimalarial drug	Combined treatment Chloroquine (CQ) with Fansidar (SP)	Coartem (ACT)	Mono-treatment with CQ, SO, Quinine, or other	Children under 5 who slept under any mosquito net last night	Pregnant women age 15-49 who slept under an ever-treated net the night before	Women 15-49 who took at least one dose of SP/ Fansidar during pregnancy	Government health facility	Private health facility or Shop/ Pharmacy/ Open market	Project/ NGO/ Church	Other or missing
Lowest	48.3	63.5	20.1	3.4	76.5	18.8	19.4	31.9	12.2	48.9	31.8	7.1
Second	44.7	56.6	24.0	5.5	70.5	19.3	22.2	33.8	7.4	65.8	18.1	8.8
Middle	37.1	61.2	21.6	3.0	75.4	13.7	21.9	35.4	3.7	65.1	13.6	17.6
Fourth	39.2	63.1	20.4	5.1	74.4	17.6	18.6	40.8	6.3	56	15.5	22.3
Highest	32.5	63.4	11.5	6.1	82.3	43.0	46.0	43.5	3.6	64.9	7.6	23.8

Source: Authors; data from Uganda Bureau of Statistics and Macro International Inc. (2006).

Preventive measures against malaria show a pattern similar to that of effective curative measures. The bottom four quintiles exhibited a rather homogeneous behavior with regard to the use of mosquito nets and chemoprophylaxis with SP during pregnancy. In contrast, children under five and pregnant women age 15 to 44 in the top quintile were about twice as likely to use mosquito nets as the rest of the population, and also more likely to engage in intermittent preventive treatment.

A study from Tanzania also found important differences in health-care seeking behavior among socioeconomic groups (Njau et al. 2006). As in Uganda, the proportion of people with a fever who sought any kind of treatment was high and similar across socioeconomic groups (see Figure 7), but the better off were more likely to seek care from an NGO provider and to obtain an antimalarial in the adequate dose. Out-of-pocket health spending on malaria treatment increased with socioeconomic status. Out-of-pocket spending by patients in government health facilities was below $0.05, indicating that public facilities delivered subsidized treatment. In comparison, out-of-pocket spending in NGO facilities was much higher (between $0.25 and $0.27) for the bottom and middle quintiles, but considerably higher ($1.34) for those in the upper quintile. Patient spending in drug stores was similar to that in NGO facilities for the bottom and middle quintiles and only slightly higher for those in the highest quintile. Spending in general shops was as low as in government facilities. Because general shops do not benefit from subsidies of any sort, these low prices cast doubts about the effectiveness of the antimalarials.

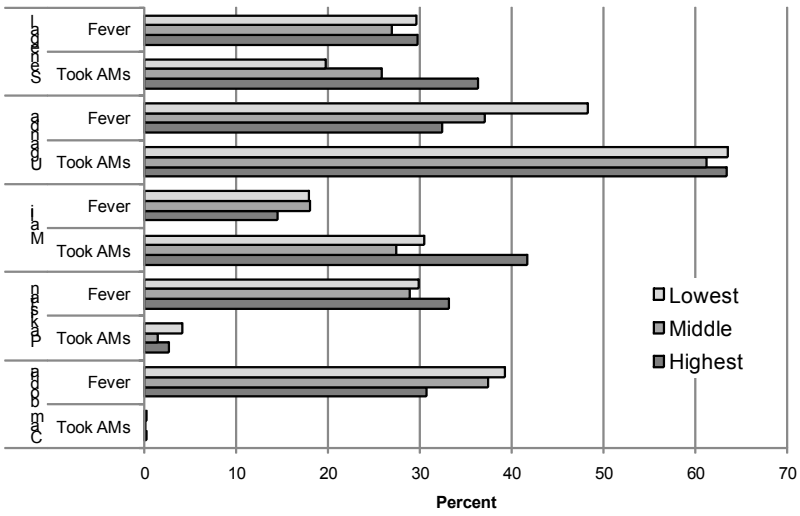
Figure 7. Tanzania: Health-Care Seeking Behavior, 2001



Source: Njau et al. (2006).

A compilation of DHS survey data is presented in Figure 8 for selected Asian and African countries. In Cambodia and Pakistan, despite an incidence of fever around 30 percent in the two weeks preceding the survey, the consumption of antimalarials was extremely low, under 5 percent in Pakistan and almost negligible in Cambodia. Uganda exhibited the highest and most uniform rate of consumption of antimalarials among those reporting a fever. In Senegal and Mali, the propensity to consume antimalarials by those afflicted by a fever increased with the SES.

Figure 8. Selected African and Asian Countries: Fever Incidence and Antimalarials, 2004–2006



Source: Demographic and Health Surveys (www.dhs.com).

A DHS survey in Angola in 2006 reveals several important differences in health status and health-seeking behavior among socioeconomic groups. Indoor residual spraying, consumption of malaria prophylaxis by women who had a child in the previous two years, and consumption of antimalarials by children under five with a reported fever in the preceding two weeks were much higher in the top socioeconomic group than in the lowest groups. On the other hand, the prevalence of malaria, according to a rapid blood test, among children under five was considerably higher in the bottom than in higher groups. This last finding

suggests that the ability of low-income individuals to recognize the symptoms of malaria may be limited, because self-reporting far less than prevalence. Thus, survey results based on self-reported health status may greatly mask large differences among groups, and a worse-than-reported situation for the poorest. A final set of results from the Angola survey (Table 3) shows that the overall consumption of ACTs was low in 2006, but was nil in the bottom socioeconomic group. The majority of treatments that individuals obtained were antimalarial mono-therapies.

Table 2. Angola: Preventive and Curative Antimalarial Measures, 2006 (%)

Socioeconomic status	Indoor residual spraying	Ownership of mosquito net	Use of mosquito nets by children under 5	Use of mosquito nets by pregnant women	Women who took any antimalarial in past 2 years	Children under 5 who tested positive for malaria	Children under 5 with a reported fever in past 2 weeks	Children under 5 with a fever who took any kind of antimalarial
Lowest	0.5	29.4	19.9	26.5	29.1	39.5	25.8	16.9
Second	2.5	25.8	17.9	24.3	54.7	24.7	23.5	27.5
Middle	1.9	39.6	25.3	26.9	75.2	11.4	21.6	27.7
Fourth	1.6	33.5	19.5	n.a.	78.8	6.1	25.3	39.5
Highest	6.0	37.6	20.6	n.a.	79.2	6.7	23.6	46.4

Source: DHS Angola (2006).

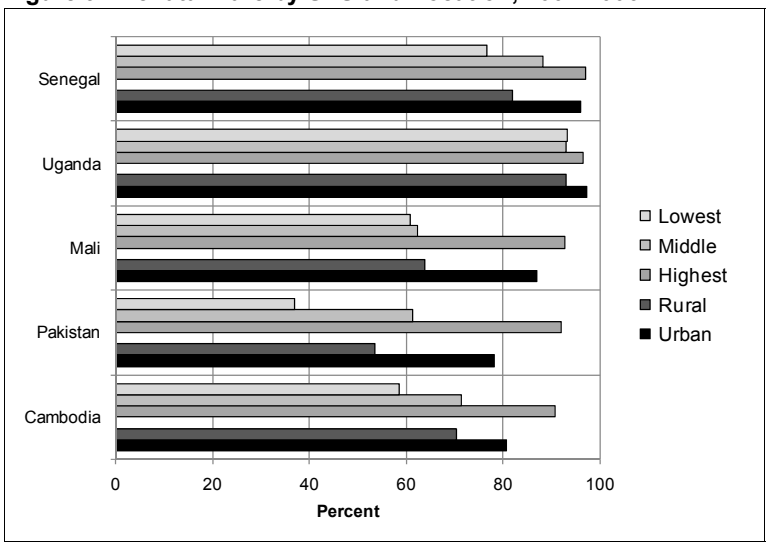
Table 3. Angola: Antimalarial Taken by Children under Five, 2006 (%)

Socioeconomic status	FP/Fansidar	Chloroquine	Amodiaquine	Quinine	ACT	Other antimalarial
3,0	73,4	23,7	-	-	-	3,0
-	46,2	33,1	15,3	5,1	0,7	-
-	50,5	35,0	13,4	10,1	-	-
-	30,4	48,9	14,9	5,8	5,1	-
3,0	50,6	35,6	-	4,3	6,3	3,0

Source: DHS Angola (2006).

These large disparities in accessing malaria treatment contrast with much smaller inequalities in accessing other kinds of health services, particularly preventive care, in these and other low income countries. As can be seen in Figure 9 and Table 4, differences in use rates for maternal and child preventive services are smaller than those for malaria treatment, particularly in the three selected African countries. For example, in Senegal and in Uganda (Figure 9) use rates for prenatal care were 77 percent for the lowest quintile and 97 percent for the highest; in Uganda they were 93 percent and 96 percent, respectively. There were larger differences in Mali and much larger differences in Pakistan and Cambodia. Still, these gaps were smaller than those seen in the access to ACTs. Relatively smaller gaps in use occur in the case of child immunizations, as shown in Table 4. The relatively high coverage rates of preventive services in these low-income countries offer the opportunity to promote, possibly through vouchers, ACT malaria treatment, and to direct to the appropriate treatment sources, those mothers seeking these services for themselves or for their children. We address this issue again in the following section.

Figure 9. Prenatal Care by SES and Location, 2004-2006



Source: DHS surveys. Senegal, Uganda, Mali, Pakistan, Cambodia.

Table 4. Vaccination Coverage for Children Age 12 to 23 Months, 2005–2007 (%)

	BCG	DPT1		Polio2		Measles	All basic vaccinations	No vaccinations
		1	3	0	3			
Cambodia 2005								
Lowest	87.0	86.9	65.6	6.4	65.8	69.9	56.1	10.9
Middle	90.6	90.3	81	9.5	78.4	77.2	66.6	7.8
Highest	93.4	91.0	84	10.8	84.1	82.4	76.4	4.4
Pakistan 2006-07								
Lowest	61.9	52.6	34.8	38.9	78.2	36.3	25.9	11.2
Middle	85.4	80.5	62.9	58	86.7	65.3	51.7	2.8
Highest	91.8	88.6	78	73.4	84.9	75.5	63.7	3.8
Mali 2006								
Lowest	72.9	82.2	65.1	46.1	61.4	67.5	48.6	13.8
Middle	73.7	82.1	67.9	51.6	63.7	66.4	48.9	13
Highest	89.6	89.9	77.4	77.7	65.9	78.1	56.2	7.3
Uganda 2006								
Lowest	93.9	90.9	63.9	51.4	55.8	66.3	41.4	3.6
Middle	89.6	89.7	67.4	38.2	62.3	66.8	48.2	8.3
Highest	87.9	88.8	64.6	57.6	61.4	73	47.9	7.3
Senegal 2005								
Lowest	92.2	91.8	72.4	41.8	70.5	71.0	71.1	5.0
Middle	90.5	92.4	81.6	50.3	74.4	71.2	70.3	4.4
Highest	93.6	97.5	84.5	67.2	77	81.2	79.2	2.3

Summary

- Survey data from selected African and Asian countries show that household self-reporting of fever or malaria over a two-week recall varies among socioeconomic groups, with no clear general trend.

- Data from Uganda on blood tests in children suggest that self-reporting of fever or malaria may greatly underestimate the true incidence of that symptom and disease.
- Access to any malaria treatment does not present consistent differences among individuals from different socioeconomic groups, but the kinds of malaria treatments obtained do vary.
- Better-off individuals are considerably more likely than the poor to obtain ACTs, and their relatively higher out-of-pocket expenditure on malaria treatment in the private sector suggests that they are also more likely to obtain adequate treatment.
- Data from one country (Tanzania) show that government providers are selected equally by all socioeconomic groups as a source of treatment for fever or malaria, whereas NGO providers are selected more often by the better off.
- Data from Tanzania also show that out-of-pocket spending on malaria treatment increases with socioeconomic status, possible reflecting differences in the adequacy of treatments delivered.
- Use of preventive measures against malaria, such as ITNs, indoor residual spraying, and intermittent preventive treatment during pregnancy are considerably higher in the top socioeconomic group than in all other groups, where use rates tend to be somewhat homogeneous.
- High rates of use of preventive maternal and child services in low income countries offer the prospect of promoting demand for ACTs among mothers, including the possibility of distributing vouchers for free or subsidized consumption of ACTs.

Box 1. Pilot Study for Subsidizing ACTs in Tanzania

In 2007 the Tanzanian Ministry of Health and Social Welfare (MOHSW) and the Clinton Foundation launched a pilot ACT subsidy project to study both the effect of an AMFm-like subsidy on ACT prices paid by rural malaria patients and the impact on price and volume of additional interventions, notably a suggested retail price (SRP). The study design involved three districts, of which two received the ACT subsidy and additional interventions and one underwent no change and was used as control (see interventions by district in Table 5).

Table 5. Tanzania Pilot Test: Supporting Interventions

	Kongwa "Price Intervention"	Maswa "Subsidy Control"	Shinyanga "Pure Control"
Subsidized drugs	Yes	Yes	No
Provider training	Yes	Yes	No
Repackaging	Yes	Yes	No
Suggested retail price	Yes	No	No
Social marketing	Awareness & Price	Awareness only	No
Data collection	Yes	Yes	Yes

In the two intervention districts, use of ACTs increased, especially by children under 5, but other age groups were underrepresented.

The retail price of ACTs dropped considerably, from the normal market price of $10 to UDS 0.51 (maximum $1.00).

The subsidized price made ACTs competitive with common antimalarials, even in remote areas.

In the intervention districts, 44 percent of patients bought ACTs at drug shops, but none in control district did so.

In urban areas, 80 percent of shops stocked ACTs and in rural areas 38 percent did so.

The presence of an SRP reduced price variation by 63 percent for infant doses, but increased it somewhat for adult doses.

Better-off individuals continue to seek treatment more frequently at drug shops.

ACTs increased as a proportion of all treatments for children under five.

By lowering retail prices, the ACT subsidy resulted in an overall increase in access to ACTs.

Source: Tanzania Ministry of Health and Clinton Foundation (2008).

Subsidizing ACTs: Concepts and Evidence

The general price subsidy AMFm intends to provide should lead to a significant reduction in retail prices of ACTs. Information from a pilot test carried out by Tanzania's Ministry of Health and the Clinton Foundation showed that subsidized ex-manufacturer prices of ACTs extend along both distribution and commercial channels and are therefore passed on to the consumer in the form of a retail price that is only a fraction of the unsubsidized price (see box 1). That general price subsidy corresponds to the so-called Step 1 subsidy referred to. This section addresses the question of whether it would be feasible to implement a so-called Step 2 targeted subsidy that would seek to further lower the purchase price of ACTs. The purpose of the Step 2 subsidy is to increase access to malaria treatment with ACTs for the poorest of the poor.

The Poorest of the Poor

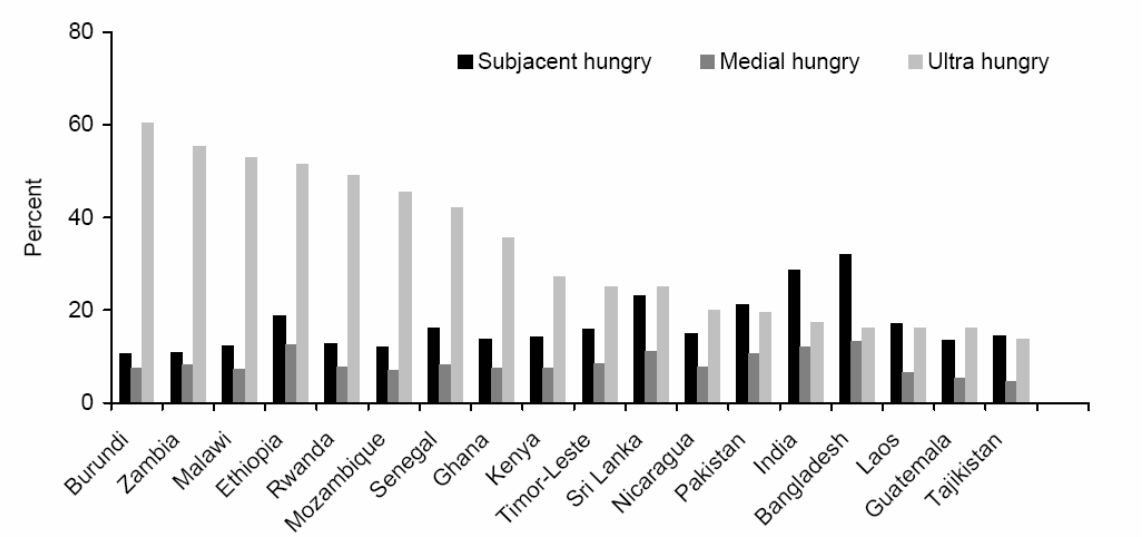
Who would be the target of such a subsidy? A cursory review of the literature failed to yield a unique definition of the concept of the poorest of the poor. For example, a document describing microfinance lending in Pakistan defines the poorest of the poor as a subset of the poor (Montgomery 2005). In a group of beneficiaries who received loans that varied between $50 and $500, 70 percent of the people were below Pakistan's poverty line, and 20 percent subsisted on less than half of the caloric consumption defined by the government as poor. Those in the 20 percent group were defined as the poorest of the poor. Also known as the core poor, they lived on less than 50 cents per day (at current exchange rates).

A recent report defines three categories of individuals suffering from hunger as follows: subjacent hungry, acquiring 1,800-2,200 kilocalories (kcals) per person per day; medial hungry, acquiring 1,600-1,800 kcals per person per day; and ultra hungry, acquiring less than 1,600 kcals per person per day (IFPR 2007). On that basis, the authors came up with estimates of daily income in $PPP (purchasing power parity, or U.S. dollars of equal purchasing value):

- Subjacent poor (subjacent hungry), those living on between US$1.08 PPP and US$0.81 PPP a day
- Medial poor (medial hungry), those living on between US$0.81 PPP and US$0.54 PPP a day
- Ultra poor (ultra hungry). those living on less than US$0.54 PPP a day

Figure 10 presents the incidence of these three measures of poverty in selected developing countries. In seven of the nine African countries included (excepting Ghana and Kenya), the ultra poor make up over 40 percent of the total population, or the bottom two quintiles of the income distribution. In Asia and Latin America, the ultra poor make up approximately one-fifth of the population, and are thus equivalent to the bottom quintile. These definitions will be used in reviewing alternatives to provide a Step 2 subsidy of ACTs.

Figure 10. National Incidences of Hunger



Source: IFPRI (2007).

Targeted Subsidies for ACTs

Subsidizing end-user prices of ACTs for the poor is challenging and different than subsidizing food, education, and other commodities for several reasons.

Uncertainty. The demand for malaria treatment, including ACTs, arises from an unpredictable event. This makes the problem of subsidizing ACTs different from that of subsidizing nonhealth goods or services, whose need is regular and predictable.

Externalities. Malaria being an infectious disease, its prevention and treatment have externalities: the cases of malaria among others that are averted as a result of preventing or treating each individual case. Owing to these externalities, the subsidization of malaria treatment, such as ACTs, on the basis of poverty becomes a different problem than the subsidization of other goods and services, such as food and transport, that do not provide externalities. The presence of externalities makes type II targeting errors (also known as *leakage* of subsidies to the nonpoor) in the subsidization of malaria treatment, less of a concern than in the case of other goods and services lacking externalities. That is so because treating the nonpoor may also confer a benefit to the poor, by reducing their exposure to infection. When externalities become very large, the good becomes a pure *public good*. If it is worth providing, that is, if it is cost effective, the public good should be financed publicly or, equivalently, subsidized for everyone, poor and nonpoor alike. Because malaria is a mixed good, neither completely private (such as food) nor completely public (such as insecticide spraying for mosquito control), the targeting of subsidies for the poor for malaria treatment makes sense on equity grounds but is not as justified on efficiency grounds.

Predominance of private commercial channels. Most malaria treatments are sold through private commercial channels, and therefore a price subsidy will have to work its way through the private sector. This marks a difference with the subsidization of other services such as public education, or child vaccinations and prenatal care, that are typically delivered through government-financed public providers. When provision is in public hands, as in the case of government health centers that offer preventive health services for mothers and children, subsidization takes the form of a historic budget and delivery is usually universal. When provision is in a highly atomized and heterogeneous set of private providers, as in the case of ACTs that are sold in private clinics, pharmacies, and shops, subsidization may

be more complex. In the absence of a mechanism such as AMFm, it would require, for example, providing individuals with vouchers with which they can obtain subsidized ACTs. The retailer, in turn, has to redeem the voucher to obtain full payment for its goods sold.

Limited knowledge of benefits. The demand for ACTs is low among the poor and the nonpoor not only because of the currently high private price, but because there is limited knowledge in the population about the benefits of this new treatment. This distinguishes the problem of ACT subsidies from that of subsidies for food, education, or other highly demanded commodities. Promoting the demand for ACTs is envisioned as one of several supporting interventions that are part of the AMFm initiative. Without it, price subsidies may be partly ineffective because demand for ACTs may be low even in the face of subsidized retail prices.

Low level of benefits. Once AMFm is implemented, the end-user price of ACTs will be low per episode and even lower when expressed on a monthly or an annualized basis. The unsubsidized cost of an adult treatment course with ACTs will be equivalent to one-half of the daily per capita international poverty line. The expected annual cost of treating malaria with ACTs in Africa is about $2 per individual.[2] Thus, subsidizing ACTs below their expected market price will be different in magnitude from the subsidization of relatively more costly commodities such as food staples (rice, cooking oil, maize, sorghum, and the like) or education subsidies. The targeting costs of such a low subsidy could be substantial thus not justifying targeted subsidization.

Need for quality control. Consumers cannot judge the quality of ACTs at the time they obtain them. This poses the need for quality control measures to be exerted by a health authority, given the detrimental consequences that false or ineffective ACTs will have on patients' health. Consumers who obtain other subsidized goods and services, such as food and education, have a relatively better ability to discern quality, and therefore public intervention in the form of quality control, while desirable, is not as essential.

Table 6. Subsidizing ACTs under AMFm

	Subsidizing ACTs under AMFm	Subsidizing food, education, other commodities
1	Need for malaria treatment *Unpredictable*	Need for food, education *Predictable*
2	Malaria treatment with ACTs *Has positive externalities*	Consumption of food, education *No externalities*
3	Antimalarials Private, self-financed often for profit	Education *Publicly-subsidized schools*
4	ACTs *Low knowledge of benefits, low demand*	Food, education, condoms *High knowledge, high demand*
5	ACT end-user price *Low ($2/household member/year)*	Prices for food, education *High ($30+)*
6	ACTs *Quality control & testing necessary*	Food, education *Consumers can better recognize quality*

Subsidy Options (Step 2 Subsidies)

Not all the options available to subsidize retail prices of ACTs are advisable or feasible, but they represent the full range of targeting mechanisms. We discuss also the pros and cons of each option, as well as the implementation requirements associated with them.

[2] Assumptions include the per capita annual incidence of 0.7 malaria episodes, average household size of 6 members, and cost per treatment of $0.50.

Universal

Under a universal price subsidy, everyone demanding ACTs would receive them at no cost or at a reduced price. An extreme policy would be free distribution of ACTs through a variety of channels, including private retailers (shops, pharmacies), doctors' and health workers' offices, government health facilities, churches, community leaders, and so on. A possible associated problem would be a high volume of demand. With ACTs free for all, people might obtain more tablets than they need and many might end up wasted. This could prove costly for the AMFm program. In addition, unsupervised free distribution may result in inadequate consumption patterns by persons afflicted with fever or malaria. It is unclear, however, whether medical risks are associated with the consumption of ACTs when they are not indicated. A DHS report from Angola (2006) shows that 6 percent of all individuals afflicted with malaria are treated with antimalarials available at home. If ACTs were distributed at no cost their availability in homes would increase and so would self-treatment. Hence the importance of addressing the dosage issue.[3]

The AMFm initiative design includes the active participation of private channels for the distribution of ACTs. If a universal price were implemented, and if ACTs intended for free distribution were procured locally through private distributors and retailers, then AMFm would have to pay the private retail cost of ACTs, which might be $0.20 to $0.50 per adult treatment. Without waste, the cost of that subsidy would be up to a 50 percent increase in what AMFm currently envisions it will have to pay for ex-manufacturer price subsidies ($0.90 per adult dose). Taking waste into account, the additional cost of this subsidy could easily equal the total price subsidy at the ex-manufacturer level.

Another option would be to bypass the private commercial sector and distribute free ACTs directly to individuals or to voluntary distribution outlets (churches, community leaders, etc.). This could prove problematic for reasons other than waste, however, because currently the private sector is the main source of malaria treatment and has a broad geographic coverage. Attempting to do without the private sector may limit physical access to ACTs, particular by the poorest, most remote populations with no easy access to public providers. Further, the program's distribution costs would not necessarily be lower than current private distribution costs. This option could be as costly as the first one, with the added disadvantage that it could hurt accessibility. It would also affect private sector activity, by removing this product from the array of products now sold by provide agents.

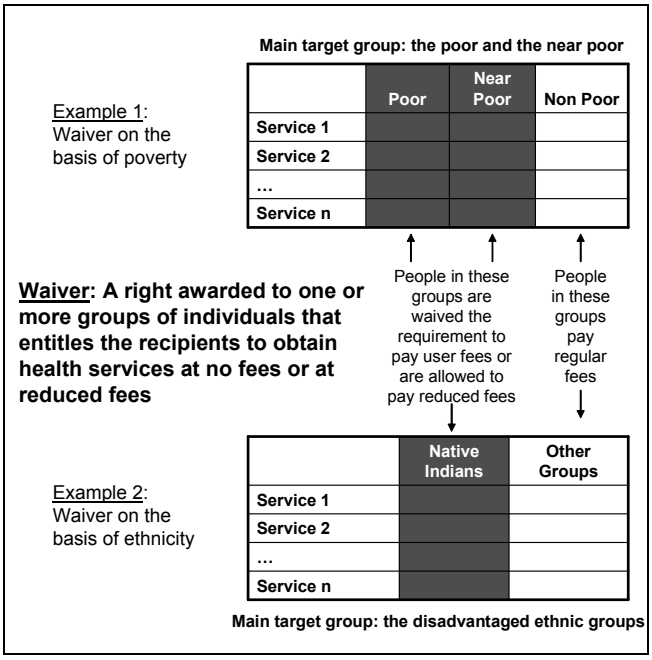
If a step 2 subsidy uses private commercial channels, a mechanism must be put in place to reimburse retailers for their cost of ACTs plus a profit. Private health providers and retailers, such as shops and pharmacies, may receive a voucher from patients or customers and they may redeem the voucher with a local agent. Patients may obtain the voucher for free from some local entity different from the retailer, and may or may not have to make a copayment in addition to submitting the voucher at the time of purchase. Vouchers have been a key component of targeted programs for other commodities in a several countries.

A key issue here is the cost of putting in place and operating a system of vouchers. The challenge rests in the fact that such systems tend to be administratively complex and costly to operate. Costs are justified when they are a relatively small share of the total resources available for the subsidized program. As mentioned, the required subsidy per treatment course will be in the $0.20 to 0.50 range. On an annual basis, this amounts to about $2.0 per person per year. The literature does offer several examples of

[3] To ensure that the right doses are taken by patients, the packaging of ACTs in various doses presentations, may be advisable, as was done for combined therapies in Tanzania (see earlier).

subsidized programs that rely on a system of vouchers, but most such programs deliver benefit levels much higher than $20.0. Thus the administrative costs of the voucher system may be only a small share of total costs. In contrast, when the subsidy is as low as $0.20 to $0.50 per malaria episode, the cost of the voucher system may represent a considerable share of total program costs.

Figure 11. Waiver



Source: Bitran and Giedion (2003).

Another issue that must be addressed in this context is that of fraud under a system of vouchers. Individuals who do not need malaria treatment with ACTs may turn in a voucher with the retailer in exchange for an economic compensation (less than $0.20 to $0.50). Such an amount, though small by Western standards, is daily income for the poorest of the poor. Thus, the incentives to cheat may be great. Preventing cheating is administratively complex and costly. However, it seems inevitable that this problem will present itself and that control systems will have to be put into place.

Among public sector health providers, the penetration of ACTs has been high: about 60 percent of all malaria treatments delivered. In addition, manufacturers offer public buyers what is called no-profit, no-loss pricing, whereby Novartis recently reduced the public-sector price of an adult treatment course of the ACT Coartem from $2.40 to $1.80. There is no information available, however, about the pricing practices adopted by public providers.[4] Grants from the GFATM and bilateral donor programs, including PMI, as well as funding from endemic-country governments, multilateral institutions, and foundations, have been critical in enabling the switch to ACTs in the public sector, and may support the provision of free or highly subsidized ACTs to patients there. The high rate of treatment with ACTs in the public sector is possible only if they deliver this drug at no cost or at a subsidized price to patients.

If public providers sell ACTs to patients to recover some costs associated with ACTs—such as the portion of purchasing costs not subsidized by donors, storage, and other handling costs—then a mechanism should be put into place to compensate public providers for those costs. In their review of waivers and exemptions for health services in developing countries, Bitran and Giedion concluded that one of the key enabling factors for such systems to function well is the timely and fair financial compensation of providers' costs, or of their forgone income (2003).

Socioeconomic Status

Public sector. In public facilities, ACTs are given free, sold at a low price, or accompanied by a relatively low consultation fee, depending on the country and on the practices of the institution. The institutions

[4] Background Paper 7, "Summary of Field Research," should contain information about observed pricing practices of antimalarials in the public and private sectors of some developing countries, but was not available at the time of writing.

themselves always get them at a highly subsidized price (or free), so they are not sold to patients at the true retail prices. Experience documented in Bitran and Giedion (2003) shows that public providers within a country or region tend not have a single, homogenous pricing policy. This situation may apply to ACTs. In fact, variations from region to region, and from one facility to another within the same region, are likely in the prices of ACTs, and in the criteria health workers use to decide how much to charge to whom. Developing a coherent ACT waiver policy among public providers should be priority. Designing such a system involves many decisions:

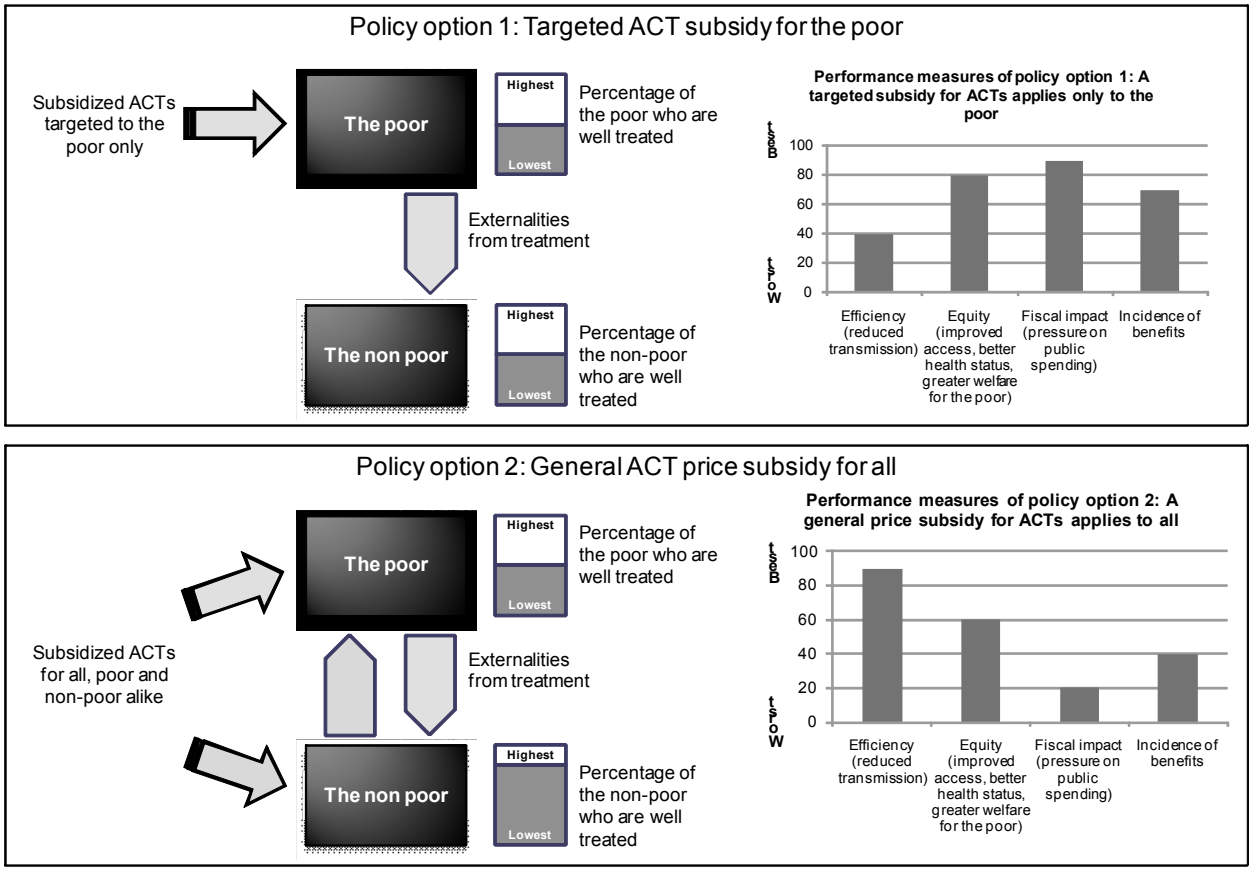
- Who will be entitled to a waiver? Everyone, or only those who qualify as poor, or only reproductive-age women and children under five?
- Will waiver rights be distributed in advance (that is, in their homes or at the workplace) or when individuals show up at the health facility? If in advance, then a mechanism for identifying the beneficiaries—the poor or the extreme poor—will have to be devised but is likely to be complex and therefore costly.
- Will the waiver be full or partial?
- Will there be a unique price level or a sliding fee scale?

The externalities that arise in malaria treatment are a powerful argument in favor of delivering ACTs free of charge, or at a uniform and highly subsidized price, to all in public facilities, regardless of socioeconomic status, age, or gender. Attempting to develop a system of waivers is likely to be costly and complex, particularly in institutionally weak environments such as those seen in sub-Saharan Africa and in some Asian countries. More important, the system may not work well, and thus effectively exclude some of the poor from the waiver (type I targeting error, or under coverage).

The pros and cons of a targeted subsidy versus a universal subsidy for ACTs are presented in Figure 12. A targeted subsidy, shown as policy option 1 in the upper part of the figure, may achieve equal rates of adequate malaria treatment for the poor and the nonpoor. The bar chart on the right shows four performance indicators. Economic efficiency will improve because the program beneficiaries will confer a positive externality to other members of society, poor and nonpoor, by not generating resistance, by not carrying the malaria parasites, and by not transmitting malaria. Equity in access to treatment will improve. The poor will have better health status, higher productivity, and greater welfare. The fiscal impact of the targeted subsidy is likely to be modest, since resources will be needed to subsidize the poor only, who represent a fraction of the total population. The targeted program will likely have a good incidence of benefits, that is, most benefits will go to the poor, though there may be—as is often the case in targeted programs—some leakage.

A universal price subsidy is shown in the bottom half of figure 12. The greater coverage of such a program will mean higher numbers of adequate treatment with ACTs. The program's impact on efficiency, in terms of the positive externalities it will provide, will thus be larger than in option 1. Equity in access may worsen, not because of lower rates of use by the poor but because of an increase in use by the nonpoor, which will create a gap in use between these two groups. The fiscal impact will be greater because the cost of a universal price subsidy will be higher, thus placing more pressure on public budgets. Governments may be able to relieve this pressure by obtaining grants from donors to cover part or all of the cost of the subsidy. Finally, the incidence of the benefits will naturally worsen, given that the subsidy is universal.

Figure 12. Pros and Cons of Two Policy Options



Source: Authors.

Delivering ACTs through public providers has the key added advantage in the ability of an organized government health system to implement treatment protocols, monitor treatment practices, and control quality. Public health facilities often have medical doctors, nurses, or other trained health workers who may be qualified to recognize the symptoms of malaria and to prescribe an appropriate course of ACTs. Thus, reinforcing the technical ability of the public system to diagnose and treat malaria, and allowing it to deliver ACTs at no cost to all patients, poor and nonpoor alike, seems advisable.

Private sector. Because the private sector is an important source of malaria treatment for the poor, a system of subsidized private sector prices is desirable. As with public sector prices, a decision must be made about targeting: would private sector price subsidies be targeted to the poor only, or would they be universal? The arguments favor a universal price subsidy for ACTs. Administrative requirements and the relatively high costs of a voucher system must also be considered.

Behavioral Requirements

ACT subsidies could be provided to individuals who engage in specific, socially desired behaviors, such as obtaining preventive health care services or attending school. Such a policy, known as a conditional transfer, may be a useful mechanism to promote demand for ACTs. Use rates for preventives services such as prenatal care, postnatal care, child growth monitoring, and child vaccinations are relatively high in African countries and among all income groups, with small differences. The delivery of those services, which generally takes place in public facilities, offers the prospect of educating mothers about the benefits of ACTs and giving them free subsidized ACTs (Step 2 subsidy) , or handing them a voucher to

obtain free or subsidized ACTs from private sources. The questions raised and conclusions about targeted versus universal provision apply here.

Geographic Targeting

Geographic targeting is an effective and efficient way of targeting subsidies to the poor or to specific population groups living together in well-defined areas. In remote rural villages in parts of Africa and Asia, where the vast majority of the population is poor, it may be worthwhile to provide free ACTs to all. The costs of attempting to tell the poor from the nonpoor are not worth the benefits, given the high incidence of poverty and the high costs of identification. Even without local, individual targeting the incidence of the subsidy will be high because most beneficiaries will be poor. Later we present several examples of geographic targeting for food and ITN subsidies.

Point of Sale, Self-Select

ACTs could be provided at no cost in places visited mostly by the poor, though such opportunities may not exist everywhere. Another risk is that free distribution of ACTs may draw nonpoor individuals as well, increasing the extent of subsidy leakage. But, as discussed earlier, such leakage may not be all bad from a social perspective, given the externalities that the consumption generates. Those delivering ACTs should be personnel trained specifically to provide instructions to recipients and answer questions about proper use.

The Poor, Specific Service

Targeting by type of service is possible when those who demand a specific service are predominantly poor. For example, commercial sex workers tend to demand health care to cure the sexually transmitted diseases they suffer. Such a group of patients would be too limited to have a significant impact on ACT availability among the poor, but if other services exist that do draw a large share of the poor, the distribution of ACTs through them would be advantageous.

Cash Transfers

Cash transfers are income supplements provided in cash or near cash (such as coupons and vouchers) to the poor. They supplement income and allow the recipient to make personal spending decisions. Given that malaria episodes are irregular and cannot be anticipated, cash transfers do not seem an appropriate social assistance mechanism for ACTs. Recipients may spend the cash on other more pressing needs and thus may not have the cash needed to purchase ACTs when a malaria episode occurs.

Targeted Programs in the Social Sectors

Grosh and colleagues (2008) recently published a report reviewing social safety nets (SSNs) around the developing world. In examining about 100 targeted programs that are part of SSNs, the study offers useful empirical information to this discussion of targeting of subsidies for ACTs. It reviews four kinds of subsidized programs for social and other services. Of these, three are targeted. The review was intended to determine the level of benefits provided by the subsidized programs, measured in dollars per beneficiary per year. The aim was to determine whether other targeted programs deliver benefit levels as low in dollar value as Step 2 subsidies for ACTs (i.e., $2.00 per beneficiary per year). Box 2 reports on the results of that review.

Box 2. Classification of Program Types

Unconditional transfers

- *Cash transfers, including near cash (vouchers, coupons, and the like)*. Needs-based social assistance, noncontributory pensions and disability transfers, family allowances, food stamps.
- *In-kind food transfers*. Targeted food transfers and rations, other food-based programs, supplements for mothers and children, school-based feeding programs and transfers.
- *General subsidies*. Subsidies for food, energy, housing, and utilities.

Income-generation

- *Workfare or public works programs.* Public works programs in which the poor work for food or cash.

Enhancing human capital and access to services

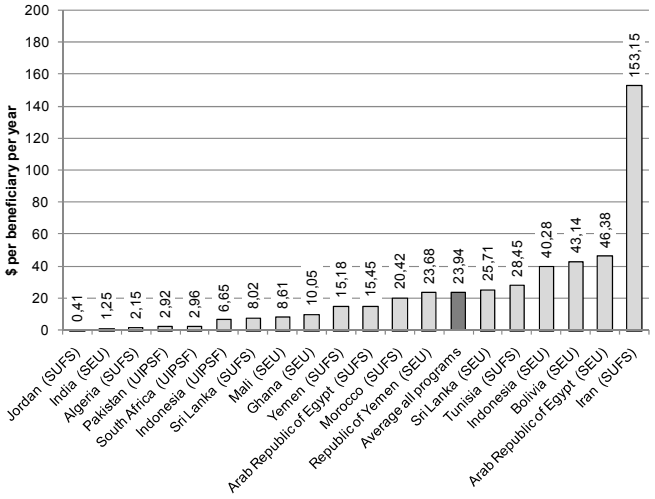
- *Conditional transfers.* Transfers in cash or in kind to poor households subject to compliance with specific conditions in relation to education and/or health.
- *Fee waivers for health and education.* Mechanisms to ensure access to essential public services, such as fee waivers for health care services, school vouchers, or scholarships.

Source: Grosh et al. (2008)

General Programs

General subsidy programs fall into two groups: universal indirect price support for food, and subsidies for energy and utilities. Per beneficiary per year, they typically range from $0.41 to $153.15. The average annual benefit is $23.94, considerable higher than the expected $2.00 subsidy for ACTs. Only five programs delivered benefits were similar in magnitude to an ACT subsidy.

Figure 13. Benefits for Selected General Subsidy Programs, circa 2000



Source: Constructed by authors from Grosh et al. (2008).

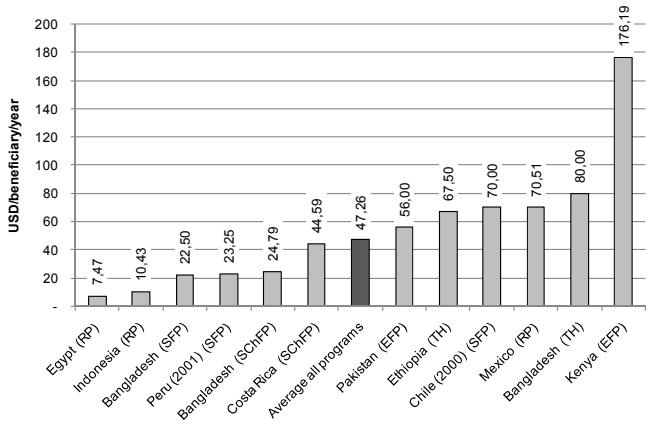
Table 7. Selected General Subsidy Programs, circa 2000 ($)

Program name	Country	Subsidies	Annual cost per beneficiary (USD)
Universal indirect price support for food (UIPSF)			
Rice subsidy	Indonesia	Stabilized rice prices through the National Logistic Agency	6.65
Wheat subsidy	Pakistan	Flour sold at a fixed price throughout the country	2.92
Value added tax exemptions	South Africa	Maize, brown bread, meat and dairy products exempted from added tax.	2.96
Subsidized, untargeted food sales (SUFS)			
Food price subsidies	Algeria	Subsidized bread, flour, rice, and oil for low-income groups	2 .15
Statutory rationing	Bangladesh	Weekly allotment of heavily subsidized basic foods, including wheat and oil	N.A.
Food subsidy system (bread and flour)	Egypt	Subsidized bread and wheat flour without quantity restrictions	15.45
Consumer food subsidies	Iran	Subsidized wheat flour and bread. Basic food available for purchase using coupons	153.15
Consumer food subsidies	Jordan	Price subsidy for barley and wheat; coupons for set amounts of rice, sugar, and milk	0.41
Food subsidies	Morocco	Price subsidy for sugar, cooking oil, and flour in unlimited quantities	20.42
Food subsidy scheme	Sri Lanka	Price subsidy for rice and staple food	8.02
Food subsidy	Tunisia	Price subsidies for cereals, cooking oil, sugar, milk	28.45
Food subsidies	Yemen	Price subsidy for wheat and wheat flour	15.18
Subsidies for energy and utilities (SEU)			
LPG, gasoline.	Bolivia	Low prices of LPG & gasoline by explicit subsidies, low producer prices, and low taxation.	43.14
Electricity, LPG, gasoline, kerosene, natural gas, diesel, and fuel oil	Egypt	Government's controlled domestic prices of all energy products	46.38
LPG, gasoline, and kerosene	Ghana	Explicit subsidies provided to refinery and distributors	10.05
Kerosene and LPG	India	Subsidized kerosene and LPG	1.25
Diesel, gasoline, and kerosene	Indonesia	Subsidized diesel, gasoline, kerosene	40.28
Energy subsidies	Mali	Restrained price increases of petroleum products	8.61
LPG, diesel, gasoline, kerosene, and electricity	Sri Lanka	Excise taxes on all products	25.71
Gasoline, kerosene, diesel, and LPG	Yemen	Subsidized petroleum products.	23.68

Food-Based (Targeted)

Benefits for food targeted programs were in the range $7.47to $176.19. Average annual benefit size was $47.24 per person. All programs delivered benefits much higher in magnitude than that of an ACT subsidy.

Figure 14. Benefits for Selected Food-Based Programs, circa 2000



Source: Constructed by authors from Grosh et al. (2008).

Table 8. Selected Food-Based Programs, circa 2000 ($)

Program name	Country	Subsidies	Targeting method	Annual cost per beneficiary (USD)	Coverage
Ration programs (RP)					
Food subsidy system	Egypt (1997)	Cooking oil, sugar, beans, other foods	Self-reported income	7.47	10 million card holders, 48 million beneficiaries
Public distribution system	India	Basic food items and nonfood products	Poor families and living in drought-prone areas	5.97	83% of all HH hold ration card of which 34% are poor
Rice for poor families program	Indonesia (2003)	Subsidized rice	Poor HH and geographic location	10.43	12 million HH
Tortivales	Mexico (1990)	1 Kg of free tortillas/day	Means test in retail stores	70.51	2.1 million low-income HH
Food subsidy program	Philippines (1998)	Subsidized rice	Give discount cards in accredited rice stores	2.41	11% of the country's 14 million HH
Take-home rations (THR)					
Vulnerable group development program	Bangladesh (2000)	30 Kg of wheat / 2 years + training & access to credit	Poorest women in rural areas	80.00	500,000 poor rural women
Gratuitous relief program	Ethiopia	Wheat, maize, & sorghum	Old age or ill health people	35— 100	2 - 5 million beneficiaries.
Supplementary feeding programs (SFP)					
National nutrition program	Bangladesh (2006)	Food supplements and counseling on nutrition and health	Pregnant and lactating mothers and children < 2	22.50	4 million women and children
National complementary feeding program	Chile (2000)	Powdered cow's milk and milk-cereal blend fortified with vitamins and minerals	Mothers and children under six at high risk for hunger	70.00	1 million children under six and pregnant and/or lactating women
Glass of milk	Peru (2001)	Milk and milk substitutes	Pregnant women, children < 13, TB patients, elderly	23.25	4 million beneficiaries
School feeding programs (SchFP)					
School feeding program	Bangladesh	Midmorning snack of 8 fortified wheat cookies	Primary schools in highly food insecure rural areas	24.79	1.21 million primary school children (2003)
School cafeterias program	Costa Rica (2004)	Breakfast and lunch	Schools where census showed students with serious nutritional	44.59	515,684 children

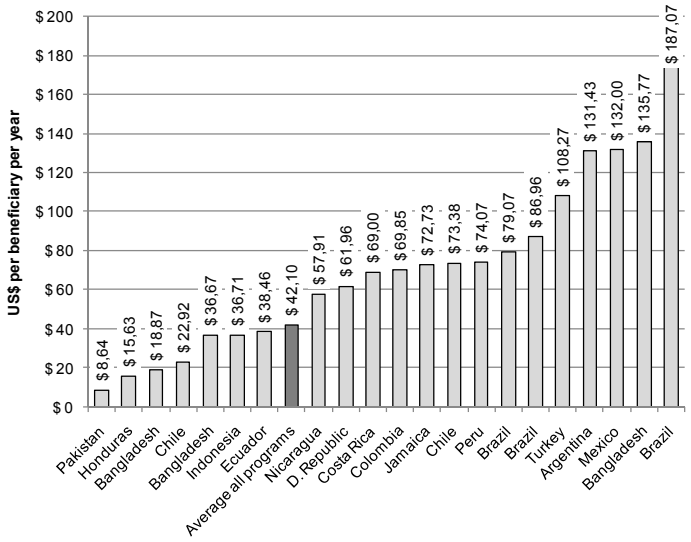
Table 8. Selected Food-Based Programs, circa 2000 ($)

Program name	Country	Subsidies	Targeting method	Annual cost per beneficiary (USD)	Coverage
			problems		
Emergency feeding programs (EFP)					
Food assistance to drought-affected people	Kenya	Food distribution, supplementary feeding, food-for-work, school feeding	Community-based targeting and distribution system	176.19	2.1 million beneficiaries
Food assistance after the South Asia earthquake	Pakistan	Fortified food commodities	Earthquake victims located remote areas	56.00	1 million beneficiaries targeted

Conditional Cash Transfer

The benefit range for conditional cash transfer programs was $8.64 to $187.07, with an average of $42.10. They were thus well above that expected benefit of an ACT subsidy program.

Figure 15. Benefits for Conditional Cash Transfer Programs, circa 2000



Source: Constructed by authors from Grosh et al. (2008).

Table 9. Conditional Cash Transfer Programs

Program name	Country	Subsidies	Targeting method	Annual cost per beneficiary (USD)
National scholarship program	Argentina	Annual scholarship of $140	Children aged 13–19 in public schools from family monthly income < $170	131.43
Female secondary school assistance program	Bangladesh	Stipend that covers tuition fees and other personal costs	Unmarried girls of secondary school age	135.77
Food for education program	Bangladesh	15 Kg of wheat or 12 Kg of rice per month per HH	Children of primary school age (6–10) who attended school	36.67
Primary education stipend program	Bangladesh	$1.7 per month per HH with one student or $2 more than one student	Children of primary school age from poor families	18.87
School grant	Brazil	$7 per month per child up to a maximum of 3 children	Families with children aged 6–15 and per capita monthly incomes < $43.	79.07
Family grant	Brazil	$30/family & variable benefit $9–$28/child (up to 3 children) per month	Poor and extremely poor families	86.96
Child labor eradication	Brazil	$11-$17/child 7–14 attending school /month	HH income per capita less than $65 a	187.07

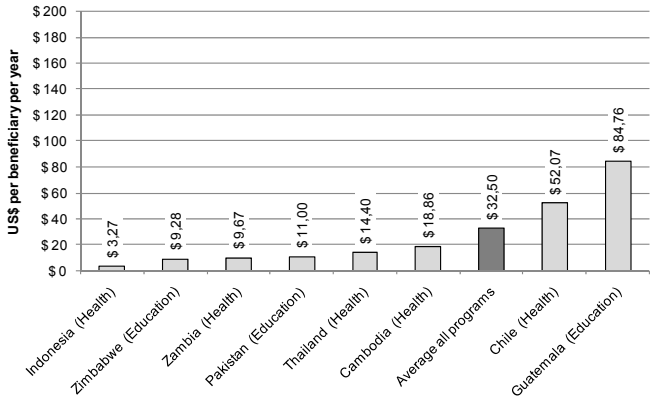
Table 9. Conditional Cash Transfer Programs

Program name	Country	Subsidies	Targeting method	Annual cost per beneficiary (USD)
program			month.	
Chile Solidario	Chile	Size of transfer $1,062 for 5 years.	Poor HHs identified through proxy means test.	22.92
Unified family subsidy	Chile	Average of $6 per child per month	Eligibility based on proxy means test.	73.38
Families in action	Colombia	Education $6-12/ child/ month. Health $20/family/ month	Poor families with children from birth through age 17.	69.85
Let's overcome program	Costa Rica	Monthly coupon of $30	Poor HHs where all children aged 6–18 attend school.	69
Solidaridad (Solidarity)	Dominican Republic	Monthly food component $17; education component $9 -19 per HH	Poor HHs with children from birth through age 16.	61.96
Human development grant	Ecuador	$15 per HH/month with children & $12/HH with elderly and/or disabled members	Poor children 0-16 years and HHs with elderly and/or disabled members.	38.46
Family allowance program II	Honduras	Education $5/child/month. Health $4/family/ month. Average school & health facility incentives $5,000/year	Poor children aged 6–12 & pregnant women and/or mothers of children <3	15.63
JPS Scholarship and grant program	Indonesia	Monthly scholarship: $1.2 primary, $2.4 junior secondary, & $3 senior secondary	Families' welfare status & 50% must be awarded to girls.	36.71
Program of Advancement through Health and Education	Jamaica	$9/beneficiary/month	Poor pregnant or lactating women, children < 17. People >65; disabled & destitute adults	72.73
Education, health, and employment program/opportunities	Mexico	Grade variable education grant, $150-850 /child/ year. $300 per completion of middle school. Monthly health grant $16 per HH & $23 adult > 70	Poor families with children aged 5-18 attending school.	132
Social protection network	Nicaragua	$34 nutritional grant; educational grant $17 per family every two months. School material support $24 per year per child	Poor families with children aged 5–13 attending school and health visits	57.91
Child support program	Pakistan	Monthly $3.5 for 1 child family, $6 for family > 2 children	Poor families with children aged 5–12 attending school.	8.64
Together	Peru	Financial incentive equivalent to $33 per month	Pregnant women & children < 14 of poorest HHs in rural communities	74.07
Social Risk Mitigation Project	Turkey	Education $13-$29 per month. Health $12 per child & pregnancy, $41 for birth at health clinic.	Poor children from birth to age 17 & women of child-bearing age.	108.27

Fee Waivers for Health and Education

Targeting methods for fee waiver programs included means tests at the household or facility, location, or health status. Benefit values ranged from $3.27 to $84.76 per person-year. The average benefit size was $32.50

Figure 16. Benefits for Fee Waiver and Education Programs, circa 2000



Source: Constructed by authors from Grosh et al. (2008).

Table 10. Waivers for Health and Education Programs, circa 2000

Program name	Country	Subsidies	Targeting method	Annual cost per beneficiary (USD)	Coverage
Health					
Basic benefits package	Armenia	Basic package of health services free of charge	Individuals in vulnerable groups. (War victims, orphans, veterans, etc.)	N.A	N.A
Health equity fund	Cambodia	Health services provided @ no charge or reduced prices	Identify socioeconomic status through interviews @ hospital	18.86	1,437 patients (2000-2002)
National Health Fund	Chile	Fund covers health services & identifies indigent for free access to health services	Middle & low-income people. Indigent are identify through a means test	52.07	8.47 million beneficiaries, 1/3 indigent (1995)
National health exemption policy	Ghana	Whole or partial exemption from payment of user fees	Poor people, some user subgroups & specific diseases of public health concern	N.A	N.A
Social safety net health card	Indonesia	Free access to basic medical care in public health centers	Household's prosperity status, determined by census	3.27	40.6 million people (2000)
Exemptions	Kenya	Exemptions of user fees for categories of patients afflicted with certain illnesses.	Poor people on the basis of income and health status determined in the facility	N.A	N.A
Low- income card scheme	Thailand	Free access to health facilities	Poor people & other groups. Selected by location combined with mean tests	14.4	15 million people (1997)
Public welfare assistance scheme	Zambia	The scheme pays approved fees to the district's health management board on behalf of the patient.	Chronically ill patients who cannot pay.	9.67	70,000 people (1999)
Education					
Plan for increasing secondary school coverage	Colombia	School vouchers to pay for tuition at private schools.	Students from low-income families who cannot obtain place @ public secondary school	N.A	More than 125,000 students (1997)
Educate the girl pilot under BES Project	Guatemala	Payments to girls and their parents in the form of scholarships or stipends.	Girls enrolled in grades 1, 2, and 3 in 12 highest gender disparity rural communities	84.76	442 recipients (1995)
Quetta urban fellowship program	Pakistan	Direct subsidy to schools for 3 years, to cover tuition fees at lowest-priced private schools	Girls in Quetta's lower-income urban neighborhoods	11.00	40 schools with 10,000 students (1998)
Rural fellowship pilot	Pakistan	Communities donate land & buildings, government provided funding for teachers' salaries	Poor girls in rural communities	89.17	1,570 students
Basic education assistance module	Zimbabwe	Fee waivers at primary & secondary school levels in urban and rural areas	Communities identify the most deserving children	9.28	970,000 children (2005)

Conclusion

General price subsidy and targeted social programs deliver benefits that tend to be much higher in dollar value than a possible ACT targeted subsidy. This raises concerns about the feasibility or desirability of a Step 2 targeted ACT subsidy, in that its administrative costs may be large relative to the subsidy amount. Because of this, and the fact that ACT subsidization benefits society as a whole because of its externalities, a general price subsidy for ACTs, with lower administrative costs but with greater leakage, may be a preferable alternative.

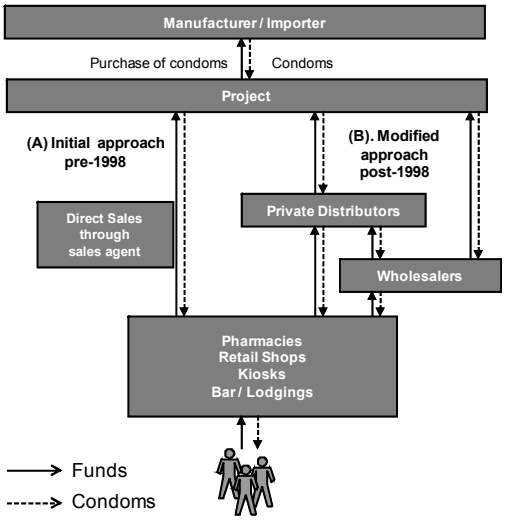
Low-Amount Targeted Programs

Here we present several case studies on targeted programs whose benefit amount is small in dollar terms, closer in magnitude to that of an ACT subsidy. The purpose is to review the design, mechanics, and performance of these programs, and to shed light on what could be the design of a targeted Step 2 subsidy program for ACTs.

Salama Condoms in Tanzania

Program description. The subsidized retail sale of salama condoms has been conducted by Population Services International (PSI) since 1993. Its goal was to make subsidized condoms available to low-income groups in Tanzania by offering them through private retail channels, such as wholesalers, pharmacies and nontraditional outlets, including bars, lodgings, kiosks and street vendors. Targeting is by type of service through increasing access and availability of condoms in nontraditional outlets, which low income customers are more likely to use. Agha and Meekers (2004) show that before 1998 the projects' main distribution method was direct sales to outlets through project sales agents (see Figure 17). Several difficulties were encountered, mainly related to logistical problems in reaching the outlets. After 1998, the project modified the main distribution method, selling predominantly to distributors and wholesalers, who in turn would sell to retailers. The project allowed for profit margins and for credit purchasing for both retailers and wholesalers. The condoms would sell to the customer at $0.03, compared to $1.00 for other brands (all costs are expressed in U.S. dollars for the year of intervention). From 1994 to 1997, 30 million subsidized condoms were sold in Tanzania. Given a GNI per capita of $230 in 1997 and an annual use of 24 condoms per adult per year, the subsidy would amount to $24 per beneficiary per year, or 10 percent of adult per capita household income.

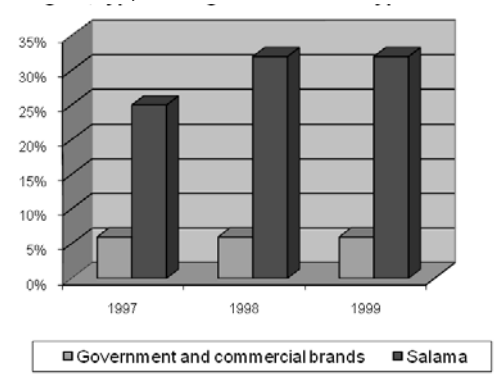
Figure 17. Subsidized Salama Condoms in Tanzania, 1993



Source: Agha and Meekers (2004).

Program Results. In the initial pre-1998 approach, project sales agents would sell on credit to retailers. This resulted in increased availability, but retailers were prone to run large debts and frequently to default. The change in strategy led to an overall increase in condom availability (Figure 18) from 25 to 33 percent in nontraditional outlets closer to low income groups, from 24 percent to 31 percent in kiosks, 11 to 22 percent in street vendors, 10 to 20 percent in wholesalers,

Figure 18. Outlets Selling Salama Condoms in Tanzania, 1993



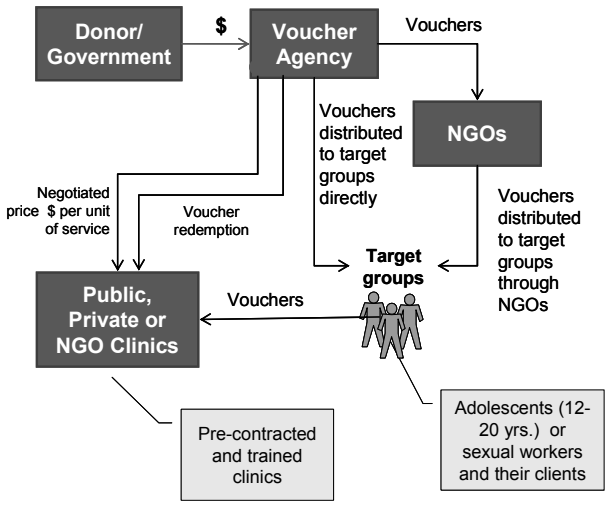
Source: Agha and Meekers (2004).

and 69 to 83 percent in pharmacies. In the new approach, visits of project sales agent to retailers, with the goal to induce retailers to sell condoms would increase the probability of having condoms available by threefold. Overall, as can be seen in figure 18, Salama condoms surpass in availability by far any other condom brand on the market in 1997, 1998, and 1999.

Vouchers for Health Care in Nicaragua

Program description. Two voucher schemes in Nicaragua were used to stimulate use of preventive reproductive and sexual health care by subsidizing health care visits, family planning, pregnancy testing, antenatal care and sexually transmitted infection treatment, including tests, drugs and contraceptives.[5] The scheme involved a group-based targeting method, with geographical mapping of low income groups and targeting towards sex workers or low-income adolescents. These groups were approached personally both by the voucher agency and by affiliated NGOs on the streets in specific areas, including markets and schools, and given a voucher that was valid for three months to be used at a previously contracted clinic where they would receive the mentioned benefits (see Figure 19). Clinic staff received training to reinforce reproductive and sexual health and disease prevention. Moreover, these vouchers could be transferred freely among peers. The average overall cost for each voucher redeemed was $41 for the project, covering all administrative and health care costs. Given that approximately 20 percent of vouchers were redeemed, then $8.20 is the transfer subsidy per person. With a GNI per capita of $770 in 2001 then the subsidy was 1.07 percent of income. Funding of the voucher pilot programs was provided by the UK Department for International Development and the Elton John AIDS Foundation.

Figure 19. Vouchers for Preventive Reproductive Health Care



Source: Meuwissen et al. (2006) & Borghi et al. (2005)

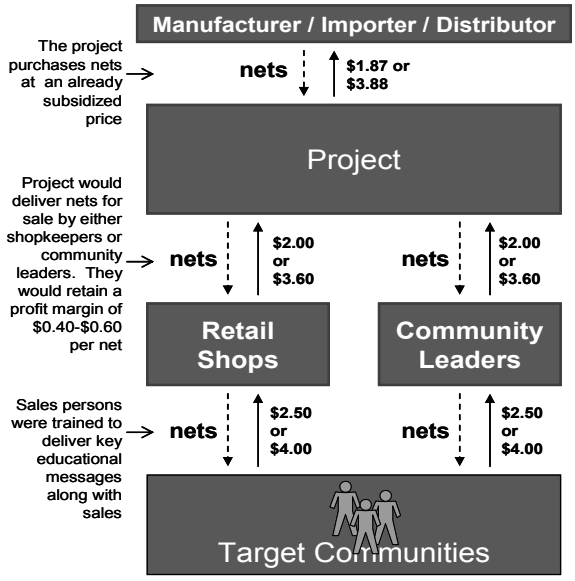
Program results. In the trial with adolescents, 20 percent of all vouchers were redeemed. In a follow-up random street survey of target groups, 34 percent of those receiving vouchers had used reproductive and sexual health care services, whereas 19 percent of those who had not had used similar services. This change in use of services was stronger for younger girls, 12 to 15 years old, and for those with fewer years of schooling. As for sex workers, a cost-effectiveness analysis showed a decrease in incremental cost of curing one STI of $82 per case compared with traditional treatment of established health-care clinics, mainly because of the increase in the probability of testing positive for some STI per consultation. The voucher system accounted for 21 percent of total program costs, where 7 percent of total costs accrued to administration of health-care provision that included contracting clinics and ordering and distributing drugs, and the rest was used in paying the health clinics.

[5] This case description is based on Meuwissen et al. (2006) and Borghi et al. (2005).

Distribution of Bednets in Mozambique

Program description. The goal of this Mozambique program, which ran from 2000 to 2004, was to make subsidized bednets available for purchase to low income communities.[6] Group targeting based on geography was used through selecting impoverished, peri-urban and rural, flood-prone areas with a high malaria transmission rate (66 cases per 100 person-year). Communities received one of two possible interventions: retail shops were enrolled to sell subsidized bednets, or bednets were given to community leaders for sale to the public. The project purchased the bednets at an already subsidized price (Figure 20). Project personnel visited sales persons monthly with the goal of overseeing bookkeeping, delivering nets, and collecting charges. Sales of bednets were complemented with promotion and education on bednet use. Promotion mechanisms included street theater, community leader meetings, and religious leader support. Sales would leave shopkeepers and community leaders a profit margin of $0.40 or $0.60 per net sold. The average discount was of $2.25 per person. Assuming a GNI per capita of $210, subsidies were 1.07 percent of income. Funding for this program was made available by a CDC grant, USAID, PSI-Mozambique, AusAID and UNICEF-Mozambique.

Figure 20. Distribution of Bednets in Mozambique



Source: Brentlinger et al. (2007)

Program results. Before and after household surveys showed an increase in household ownership of bednets from 5.35 percent to 40.8 percent, with a higher urban than rural coverage (over 50 percent compared to 15 percent). Socioeconomic status (SES) was the best predictor of ownership, where higher SES was related to ownership. Households with pregnant woman and children under five were negative predictors of ownership, despite being the most vulnerable groups. Meetings with community leaders were a positive predictor of ownership. The cost for the project per net sold ranged from $1.75 to $50.39, depending on performance of site. This high variation in cost is attributable primarily to logistical difficulties in deliver nets to some localities—where sales were low, administration was weak, and time and resources to visit these localities were high. Transportation challenges were underestimated and central warehousing was also a problem, being subject to theft, fire, and small capacity. Another important finding was that community leaders were inadequate as sales persons. Table 11 outlines a comparison of community leaders and shopkeepers as vendors of nets. Whereas community leaders mostly all dropped out of the program, none of the shopkeepers did. Community leaders accumulated substantial debt and presented much lower sales. Shopkeepers had far better financial skills, but community leaders did better in educating clients and promoting net retreatment.

[6] Brentlinger, P. E., M. A. C. Correia, et al. (2007). "Lessons learned from bednet distribution in Central Mozambique." Health Policy and Planning 22(2): 103-110.

Table 11. Vendors of Insecticide-Treated Bednets

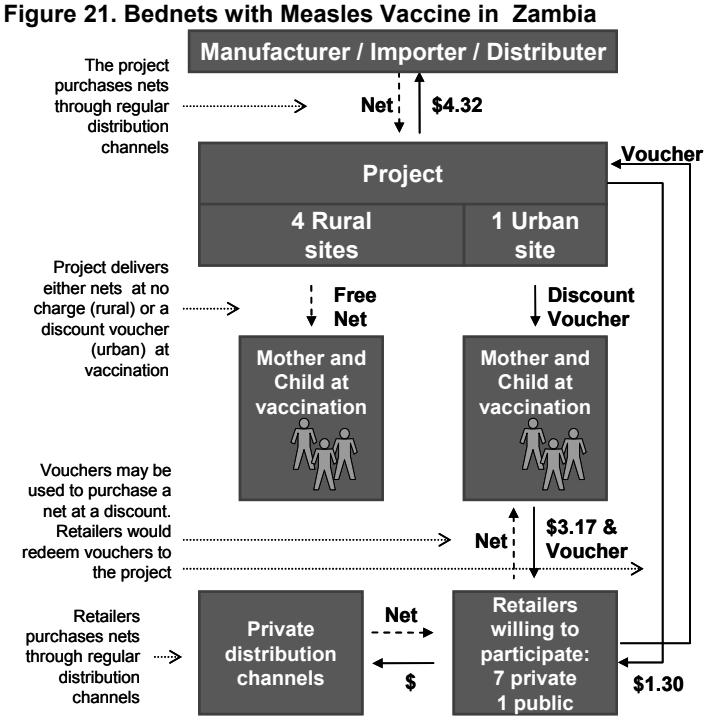
	Community leaders	Shopkeepers
Number of persons initially trained to sell ITNs (2000-03)	152	9
Number of persons still selling ITNs by May 2004	7	9
Nets sold during last month of evaluation	54 (only 2 of the original 10 sites made any sales during this month)	334
Maximum accumulated debt (sales proceeds not returned to NGO), total for group	US$8373	none
Management of sales records and proceeds	Poor (with exceptions)	Excellent
Capacity for storage of nets	Limited	Very good
Education of clients for bednet use and re-treatment	Very good	Poor
Participation in re-treatment campaigns	Very good	None
Clients	Community residents	Community residents, commercial travellers, passers-by

Source: Brentlinger et al. (2007)

Bednets with Measles Vaccine in Zambia

Program description. The Zambia program was a trial to incorporate delivery of bednets or discount vouchers for bednets in measles vaccination campaigns (June 2003).[7] These campaigns usually occur for a week every three to four years, usually with over 90 percent coverage to children age nine months to 14 years old, regardless of socioeconomic status. Targeting was thus based on age and geography to children in poor rural districts. Three months of planning with immunization teams was required. Logistics included transport of nets from the capital to district capitals by Red Cross personnel and then to vaccination posts by District Medical Officers. Five sites were selected for the project, four rural and one urban. At rural sites, nets were delivered free of charge to the mother at the time of vaccination (see Figure 21). At the urban site, mothers were given a discount voucher to use at participating retail outlets, where they would purchase a net with a $1.89 discount, rather than paying the full $5.00. Participating retail outlets obtained nets through regular commercial distribution channels and could redeem vouchers at $1.30 each. One government clinic participated as a retail outlet. The subsidy

Figure 21. Bednets with Measles Vaccine in Zambia



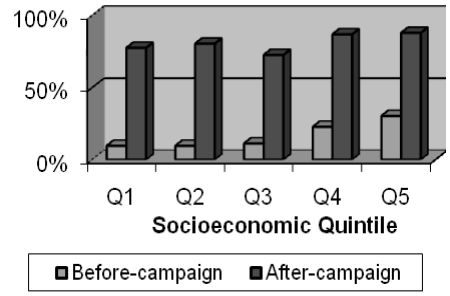
Source: Grabowsky et al. (2005)

[7] Grabowsky et al. (2005). Bednet distribution was supported by the Zambia National Malaria Control Programme, Zambia Ministry of Health, Zambia Red Cross, NetMark, Canadian International Development Agency, International Federation of Red Cross and Red Crescent Societies, the Centres for Disease Control and Prevention, the World Bank and Right to Play.

amount was $5.00 in rural areas and $1.89 in urban areas. Assuming a GNI per capita of $350, subsidy accounted for 1.43 percent of rural income and 0.54 percent of urban income.

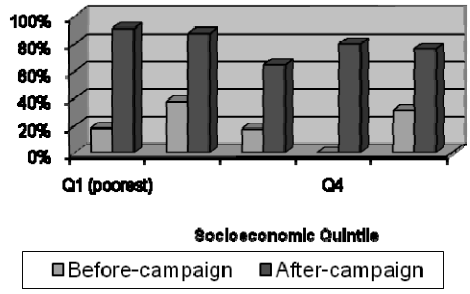
Program results. Population-based household surveys before and after the campaign showed a significant increase in bednet ownership, from 21.1 percent to 88 percent in rural areas (Figure 22) and from 49 percent to 82.3 percent in the urban district (Figure 23). Equitable distribution across households also improved, where the ownership equity ratio (ownership rates of the poorest quintile divided by that of the richest quintile) improved from 0.32 to 0.88 in rural areas and from 0.66 to 1.19 in urban areas. One drawback of the program is that attaching to vaccination campaigns leaves out coverage to other vulnerable groups, such as pregnant woman, children under six months and those born after the campaign for three years to come, until the next campaign. This is because vaccination campaigns occur every three to four years. A cost analysis comparing rural direct delivery and the urban discount voucher system indicates that operational costs per net delivered are similar for both systems, $0.34 for each net delivered in rural areas and $0.59 per net delivered in the voucher system. This does not include net procurement costs that might fall on either the program or target group.

Figure 22. Household Ownership of ITNs in Rural Districts



Source: Grabowsky et al. (2005)

Figure 23. Household Ownership of ITNs in Urban District

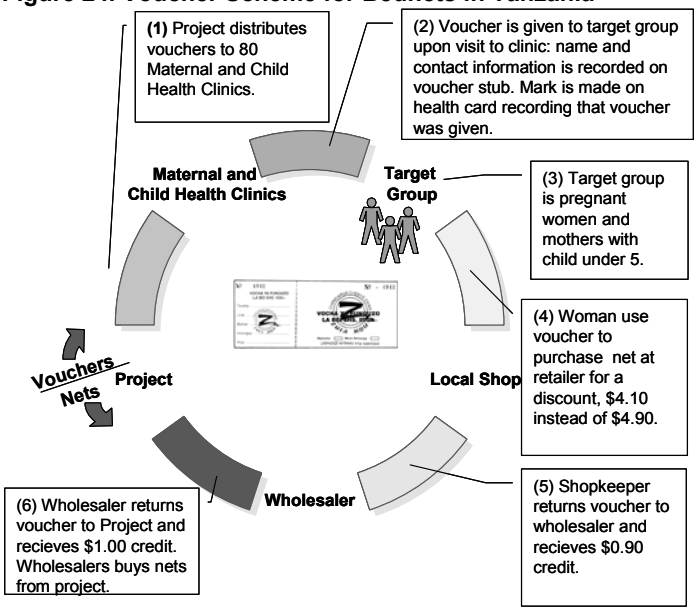


Source: Grabowsky et al. (2005)

Vouchers for Bednets in Tanzania

Program description. This Tanzania program, which ran from 1997 through 1999, used group-based targeting to distribute bednets to women and children under five years of age with the goal of decreasing purchasing price, increasing equity and stimulating behavior change.[8] The project first distributes vouchers to 80 Maternal and Child Health Clinics from which the target group is expected to come (Figure 24). Each voucher is given to a target group member on visiting a clinic. The mother's name and contact information is recorded on the voucher and the voucher stub, and a special mark is made on the health card recording that a voucher was given out. The woman then takes the voucher to a retail outlet and uses it to purchase a bednet at discount, paying $4.10 rather than the usual $4.90. The shopkeeper then returns the voucher to a wholesaler and for each voucher receives $0.90 credit on the next set of bednets they buy. The wholesaler in turn returns the voucher to the project and receives in $1.00 credit on the purchase of bednets from the project. The discount voucher is equivalent to 17 percent of the normal retail price. Assuming a GNI per capita of $230 in 1997, the subsidy was equivalent to 0.35 percent of income. A parallel communication strategy utilizing social marketing was performed to increase demand for bednets.

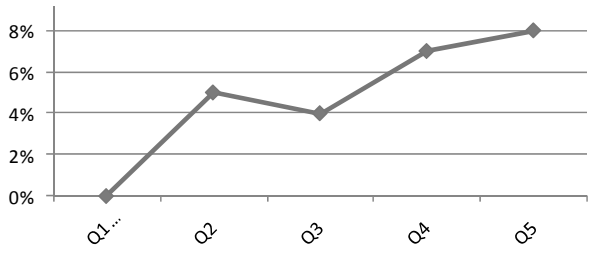
Figure 24. Voucher Scheme for Bednets in Tanzania



Source: Mushi et al. (2003)

Program results. Of all vouchers distributed, 97 percent were redeemed. The evaluation period was from 1997 to 1999, with qualitative and quantitative research and voucher tracking in 2003. Slow program uptake was determined in a survey, which found that only 12 percent of interviewed target group had used a voucher and only 43 percent had heard of the scheme. Similar results were found in later phases. Moreover, lack of understanding of the scheme was frequent. Other important barriers to uptake were insufficient cash to use the voucher and supply shortages. A tracing of randomly selected redeemed

Figure 25. Voucher Use by Socioeconomic Group



Source: Mushi et al. (2003)

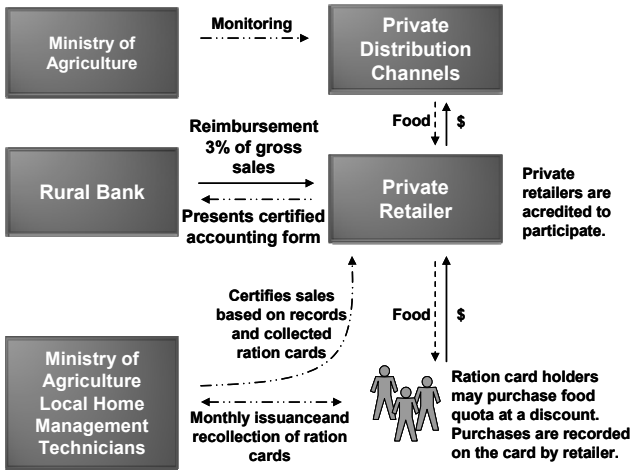
[8] Mushi et al. (2003). Tami et al. (2006). KINET was funded by the Swiss Agency for Development and Co-operation and the Government of Tanzania.

vouchers revealed that 62 percent of the people named on the vouchers were not traceable, suggesting misuse of vouchers through the collusion of retailers with health clinic personnel. This leakage is probably an overestimate, given that some voucher recipients might have been travelers passing through and therefore not known by local community leaders. Survey results show a small benefit to the poorest, where the distribution of voucher use was higher with higher socioeconomic status (see Figure 25).

Food Subsidy in the Philippines

Project description. In the 1980s a food subsidy to combat hunger delivered through discount vouchers was piloted in the Philippines.[9] Group targeting based on geography at the village level was implemented by malnutrition status of the villages. Households received monthly coded, nontransferable cards to buy a quota of rice and cooking oil at a discounted price at local accredited retail shops. The card would be signed by the shopkeeper to indicate that the person received their monthly quota. The shopkeeper would also record the sale in a sales book. Ministry of agriculture locally based home management technicians would re-collect ration cards and certify sales books. Certified sales records would be used by private retailers to redeem a 3 percent reimbursement of gross sales at a public rural bank. The subsidy transfer was equivalent to $0.79 per household per month, given a GNI per capita of $1000 in 1985, the subsidy was equivalent to 0.32 percent of income (assuming household of four).

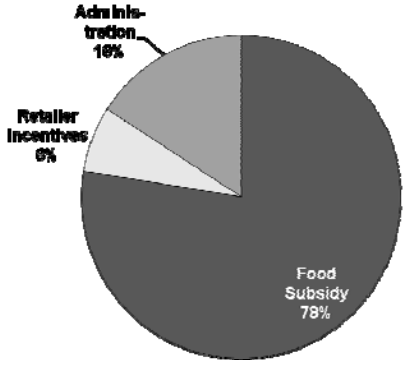
Figure 26. Food Purchase Discount Subsidy in the Philippines



Source: García (1988)

Program results. Overall, relatively good targeting outcomes were obtained. No malnutrition was found in 10 percent of households who received subsidies, therefore this should be considered leakage. Fraudulent behavior was seen as quotas were based on family size and 20 percent of households misrepresented their size by including outside relatives. Furthermore, subsidy food resale was observed for cooking oil. Overall leakage was estimated by the author at 18 percent. Of total program costs (figure 27), administration costs accounted for 16 percent and retailer incentives were 6 percent.

Figure 27. Food Subsidy Distribution of Program Costs in the Philippines



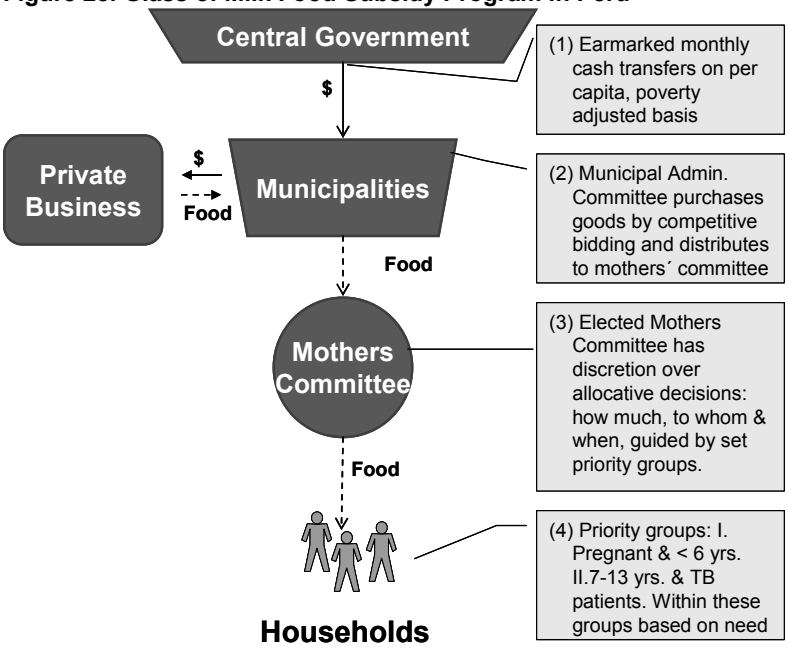
Source: García (1988)

[9] Garcia, M. (1988). Food Subsidies in the Philippines: Preliminary Results.

Glass of Milk (Vaso de Leche) in Peru

Program description. This program started in 1984 with the aim to combat hunger in Peru and consisted of a two-stage targeting scheme to deliver milk, milk substitutes, cereals or other commodities to priority group households.[10,11,12] The first stage, based on geography, consisted of central allocation of funds from the government to municipalities through earmarked monthly cash transfers based on a per capita poverty adjusted rule (Figure 28). Later, municipalities would purchase food commodities and deliver them to households through a mothers' committee (individual targeting, community based) that had discretion over to whom, how much, and how often the food would be distributed.

Figure 28. Glass of Milk Food Subsidy Program in Peru



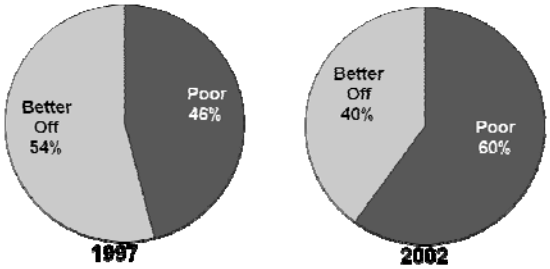
Source: Stifel and Alderman (2003)

These committees were expected to deliver food to priority groups, which included a first tier (households with pregnant woman and children under six years of age) and a second tier (children seven to 13 years of age and tuberculosis patients). Distribution within these groups was to be based on need. The average annual per capita transfer was $18 (2002). Assuming a GNI per capita of $2370 per capita in 1997, the subsidy was equivalent to 0.76 percent of income.

[10] Stifel, D. and H. Alderman (2003). "The "Glass of Milk" Subsidy Program and Malnutrition in Peru." World Bank Policy Research Working Paper 3089.
[11] López-Cálix, J. R., L. Alcazar, et al. (2002). "Peru: Public Expenditure Tracking Study." Peru: Restoring Fiscal Discipline for Poverty Reduction: Public Expenditure Review, Report No.24286-PE, June 28, 2002 (Chapter 4, pp. 57-85).
[12] PERU: Restoring Fiscal Discipline for Poverty Reduction. COUNTRY DISTRIBUTION DRAFT Report No. 24286-PE Document of the World Bank and the Inter-American Development Bank.

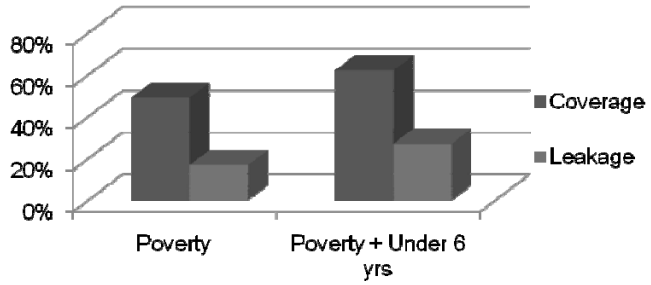
Program results. The program covered 44 percent of all households with young children nationwide. An evaluation of the program in 1997 showed that 46 percent of all transfers of the program reached the poor. This percentage increased to 60 percent in 2002 (Figure 29). An evaluation of program leakage shows that this was low at the central government level and increased significantly at the community level. This change was basically attributable to committee members who resold commodities or applied other criteria to distribute goods. Commodities were found to be resold at provincial capitals. In a population-based survey coverage of the program to poor households was found to be 49 percent, if coverage is assessed for poor households with children under age six, then coverage estimates are 62 percent. Leakage was estimated to be 17 percent and 27 percent for each targeting criteria respectively.

Figure 29. Total Transfers in Vaso de Leche Program in Peru



Source: Stifel and Alderman (2003)

Figure 30. Coverage and Leakage in Vaso de Leche Program in Peru

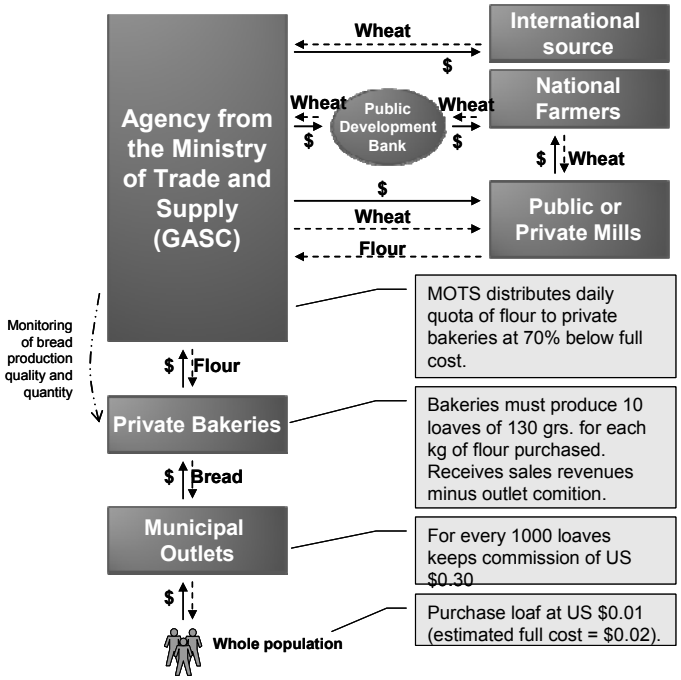


Source: Stifel and Alderman (2003)

Bread Subsidy in Egypt

Program description. The Egyptian government initiated a national food subsidy program after World War II.[13] It has evolved in time and here we describe its functioning and results in the period around 1997. Targeting by self selection is used because the subsidy is available to all, but is expected to be mostly used by the poor. Three qualities of bread are usually available and only the lowest quality one is subsidized (*baladi*), which is expected to be consumed more in absolute and relative terms by low income groups. Unrestricted consumption is available to the entire population. The bread is sold through municipal outlets that receive it from private bakeries. End consumer prices are fixed by the government and the private sector participation is highly regulated (Figure 31). The average subsidy transfer is of $19 per person per year.

Figure 31. Bread Subsidy System in Egypt

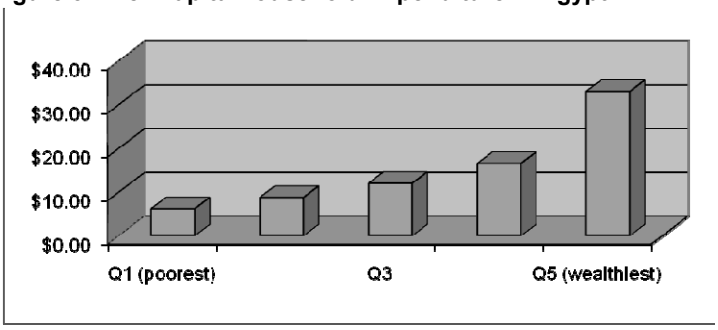


Source: Adams (2000) & Ahmed et al. (2001)

[13] This case draws on Adams (2000), Ali et al. (1996), and Ahmed et al. (2001).

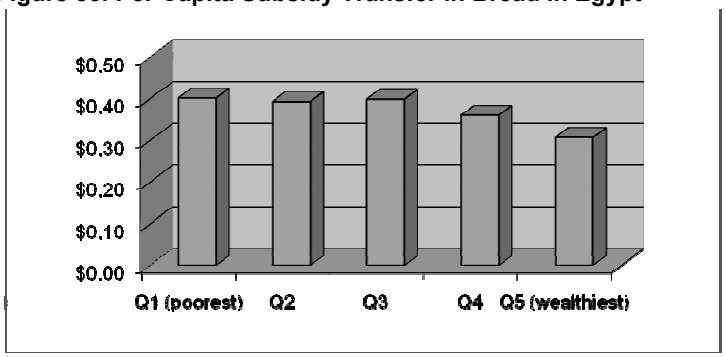
Program results. Population-based household surveys that quantify weekly per capita expenditure of *baladi* and other goods shows that *baladi* is an inferior good, consumed in both relative and absolute terms by the poorest quintile. Total transfers are distributed in 17 percent to richest quintile and 22 percent to poorest. Subsidy represents 8.74 percent of total expenditure for the lowest quintile, and 1.43 percent for the highest quintile (Figure 32, Figure 33).

Figure 32. Per Capita Household Expenditure in Egypt



Source: Adams (2000)

Figure 33. Per Capita Subsidy Transfer in Bread in Egypt



Source: Adams (2000)

Further Evidence

A review of insecticide treated bednet delivery systems was carried out by Webster et al. (2007),[14] where the authors categorize these delivery systems and evaluate their performance in terms of coverage and equity. The proposed matrix crosses the delivery sector (public, private, mixed, or community-based) with the cost of the bednet to the end user (free, partial subsidy, unsubsidized).

Public delivery channels, usually under local or central government control, include delivery of bednets with routine services such as Antenatal Care, Expanded Programme on Immunization and UNICEF´s Accelerated Child Survival and Development program; delivery through enhanced routine services such as child health days and child health weeks; and delivery with campaigns such as measles, vaccine, and polio national immunization days. Public delivery channels were either free to end users or partially subsidized. Delivery through polio vaccination campaigns was door to door and, to avoid carrying nets, discount vouchers were distributed.

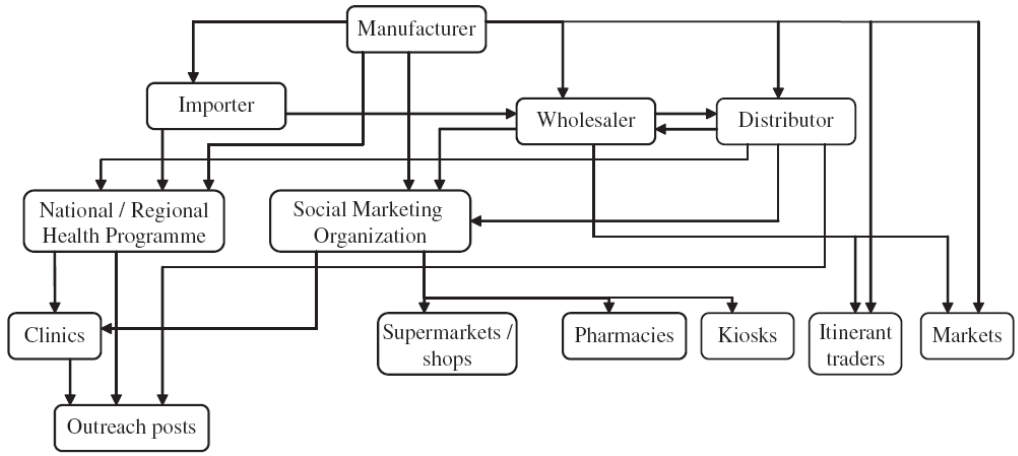
Mixed public-private delivery channels include delivery through assisting public routine services or voucher schemes with routine services and campaigns, where private organizations would attach to public services to deliver bednets or discount vouchers for purchase of nets. Most of these programs were only partly subsidized. A noteworthy example is the Population Services International work in delivering partially subsidized bednets in 10 countries (Angola, Benin, DRC, Kenya, Madagascar, Malawi, Mali, Rwanda, Zambia, and Zimbabwe).

Private delivery channels include delivery to employees at the workplace and the use of formal and informal retail outlets by nongovernmental organizations where these programs might deliver the nets

[14] Webster, J., J. Hill, et al. (2007). "Delivery systems for insecticide treated and untreated mosquito nets in Africa: categorization and outcomes achieved." Health Policy Plan. 22(5): 277-293.

directly to retailers or through wholesalers. Community-based delivery might include NGOs working with community, women's groups, and on the like (see figure 34).

Figure 34. Delivery Systems for Mosquito Nets



Source: Webster et al. (2007)

Household ownership coverage and equity outcomes of these programs, when available, show important variations across interventions (Table 12). Public delivery programs reached the highest coverage rates, ranging from 62.5 percent to 94.4 percent. Mixed public–private mechanisms showed lower rates at 43 percent-73 percent. Although private channels varied from 20 percent to 59 percent coverage and a community-based system showed 50 percent coverage. Equity ratios show a similar distribution, where public initiatives reached the highest level of equity (Table 12). In interpreting this information, we recognize weakness in the use of data to compare the related merits of each program. Few studies report outcomes, and many report different, noncomparable indicators. Coverage levels might be attributable to previous coverage levels rather than to the intervention. Moreover, cost-effectiveness and sustainability were not evaluated. The high level of coverage obtained in attaching delivery to vaccination campaigns might be a catch-up solution but might not keep up over time. Randomized trials with evaluation periods of at least three to five years are critical to definite conclusions.

Table 12. Outcomes for Indicators in Bednet Delivery Systems

Delivery Channel Clasification	Range of Household Ownership Coverage	Range of Equity Ratios
Public	62.5% - 94.4%	0.88 - 1.19
Mixed	42.9% - 73.0%	0.11 - 0.60
Private	19.9% - 59.0%	0.14 - 0.44
Community Based	50.0%	N/A

Source: Webster et al. (2007)

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Distribution of Artemisinin-Based Combination Therapies through Private-Sector Channels: Lessons from Four Country Case Studies

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Introduction

Since the 1970s, prompt treatment with chloroquine (CQ) and other simple and inexpensive therapies has been a cornerstone of malaria control efforts around the world. By 2000, however, chloroquine-resistant malaria parasites were pervasive throughout many countries, rendering the drug largely ineffective and contributing to increased mortality in some areas (World Health Organization/UNICEF 2003). In response, many governments switched national first-line treatment policy to sulfadoxine-pyrimethamine (SP) (East African Network for Monitoring Antimalarial Treatment 2003), but resistance to SP rapidly emerged soon after its introduction, jeopardizing not only patients with clinical illness but also the intermittent presumptive treatment strategy for pregnant women (Farooq and Mahajan 2004).

In response to this crisis, the World Health Organization changed its guidelines to recommend artemisinin-based combination therapies (ACTs) as first-line malaria treatment in 2001 because of their high efficacy and ability to limit the development of further resistance. The subsequent launch of the Global Fund to Fight AIDS, Tuberculosis began providing countries with the financial confidence needed to switch to these more expensive therapies. Today, nearly all malaria endemic countries have adopted ACTs as first-line treatment. With funding from the Global Fund, the U.S. President's Malaria Initiative, the World Bank, and others, many of these countries have made substantial progress in delivering ACTs to patients through public health systems (UNICEF/Roll Back Malaria Partnership 2007). However, because of their considerably higher cost (10 to 40 times higher than CQ), few who seek treatment in the private sector are accessing ACTs, but are instead continuing to purchase suboptimal therapies such as SP and CQ or antipyretics (Laxminarayan R et al. 2006).

Treatment-seeking patterns differ substantially between countries, and robust evidence to define the patterns is scarce. Studies indicate, however, that most patients seek treatment in the private rather than the public sector (McCombie 1996; Yeung and White 2005). Numerous factors drive this use, including the distance to, long wait times at, and poor availability of drugs in public sector facilities, all of which are related to the fundamental strength of the health system (Foster 1995; Brugha and Zwi 1998). Private-sector treatment sources vary considerably between and within countries, ranging from private hospitals and clinics to one-room drug shops to general stores and medicine peddlers (McCombie 1996). Moreover, relatively little data exist on the supply and demand of antimalarials in the private sector, inhibiting the development of effective, evidence-based interventions. As a result, despite the important role of the private sector in providing treatment, few large-scale efforts have been launched to increase ACT access through this channel.

In response to low ACT access and the threat of artemisinin resistance, an Institute of Medicine committee recommended, in 2004, the creation of a global subsidy to make ACTs available through both the public and private sectors at the same price as CQ and other common therapies (Institute of Medicine 2004). By reducing the price of the drugs at the manufacturer level, ACTs will flow through the same channels used to distribute those other therapies, thereby dramatically increasing access to ACTs and correspondingly reducing use of artemisinin monotherapies—and the development of artemisinin resistance—and other suboptimal drugs (Roll Back Malaria Partnership 2007). This concept was later further developed by the Roll Back Malaria Partnership into a potential new global mechanism known as the Affordable Medicines Facility—malaria (AMFm). The AMFm is now under consideration by the governing Board of the Global Fund and may be launched in an initial set of countries in 2009 (Global Fund To Fight AIDS 2008).

As the AMFm has been developed and debated over the past year, numerous questions about its impact have been raised. Will a subsidy be passed through to consumers or absorbed by middlemen? What interventions must be implemented within countries to ensure uptake and quality of ACTs, and what interventions will enhance its effectiveness? How will a subsidy affect vulnerable groups, notably young children and the poor? Most important, will a subsidy available to the private sector dramatically increase overall coverage of ACTs for people with malaria in high burden countries? Models have provided guidance, but policymakers are also interested in empirical evidence for additional answers (Laxminarayan et al. 2006). No studies, however, have yet been published on the distribution of subsidized ACTs in the private sector, and initiatives with other therapies, such as CQ, are often not relevant because the cost of the drug was not subsidized (Roll Back Malaria/Malaria Case Management Working Group 2005).

In recent years, a number of countries have developed or launched initiatives to distribute subsidized ACTs through the private sector. These efforts are typically small, either geographically or in the type of outlet involved, but they can provide valuable lessons to guide the design and launch of AMFm. This paper presents the available data and associated lessons from a subset of these programs.

As shown in table 1, ACT subsidies are planned or have been put in practice in 12 countries in sub-Saharan Africa and Asia. Data are not available in most countries on the outcomes, however, either because evaluation is not yet completed or because it was not built into the project. Of the four countries where results are available, two, Kenya and Tanzania, were designed as pilot projects and thus have substantial baseline and postintervention data. Cambodia was the first to introduce an ACT subsidy in the private sector and, though an explicit evaluation was not conducted, data from surveys before and during implementation provide useful insight. Last, a single survey, with limited but useful data, was conducted during a subsidy initiative in Senegal. Experiences in these countries cannot answer all relevant questions about private-sector ACT interventions. The studies in this paper focus primarily on ACT stocking, uptake, and pricing. The programs differ widely, each with unique distribution systems, retail outlets, accompanying interventions, pricing, country settings and evaluation methodologies. These differences made it impossible to robustly compare outcomes, but key findings did emerge that can inform both policy and research priorities.

Tanzania

In Tanzania, more than 90 percent of the population is at risk for malaria, an estimated 14 to 18 million are clinical cases, and 100,000 die from related causes each year. Studies suggest that 40 to 50 percent of Tanzanians seek treatment for malaria from private sector sources, including private health facilities,

registered pharmacies, small drug stores (*duka la dawa baridi)*, and general stores (Goodman 2004; Tanzania National Malaria Control Programme 2007). With more than 8,000 outlets nationwide, *duka la dawa baridi* have been documented as the most common source for antimalarials in the private sector (Tanzania Food and Drug Authority 2007). In response to high rates of resistance to choloroquine and other therapies, Tanzania switched its national guidelines for first-line malaria treatment to ACT, specifically artemether-lumefantrine (AL), in 2006. ACTs are classified as prescription-only medications and are therefore not sold legally through *duka la dawa baridi* and general stores, which are restricted to sales of over-the-counter medication, and their availability has remained largely limited to health facilities and registered pharmacies (Kachur et al. 2006).

In October 2007, the Tanzanian Ministry of Health and Social Welfare (MOHSW) and the Clinton Foundation HIV/AIDS Initiative (CHAI) launched a pilot ACT subsidy project to evaluate a new approach to increasing ACT access in the private sector. Specifically, the pilot was designed to assess the impact of the subsidy on price and uptake of ACTs and the effect of a suggested retail price (SRP) on those outcomes. The pilot is being implemented in three rural districts. Kongwa, in the center of the country, and Maswa, in the northwest, are the intervention areas and receive both subsidized ACTs and a varying package of other support. Shinyanga Rural district, also in the Northwest, where only monitoring and evaluation are conducted, serves as a control. All three districts fall in areas of stable malaria transmission. The Tanzania Food and Drug Authority granted provisional over-the-counter status for AL to enable it to be sold through *duka la dawa baridi* in Kongwa and Maswa.

The project is centered on distribution of ACTs to private outlets at highly subsidized prices. CHAI brings AL into Dar es Salaam and sells it to an established national pharmaceutical wholesaler at 88 percent below the manufacturer's price ($0.12 overage compared to $1 normally). The wholesaler then uses existing distribution channels, including sale to regional distributors, to deliver the ACTs to *duka la dawa baridi* in the two intervention districts. Before distribution, a suggested retail price (SRP) of $1 for an adult dose is applied on the packaging of ACTs distributed in Kongwa district.[2] In addition, Population Services International (PSI) disperses a package of supporting interventions before and during distribution to generate demand for subsidized ACTs and improve the quality of care patients receive from *duka la dawa baridi*. The package includes behavior change campaign materials related to prompt treatment, proper use of ACTs, shopkeeper training, ACT storage and dispensing, and simplified dosing instructions using pictures and the local language, Kiswahili.

[2] Prices were set on a per pill basis so as not to create incentives for customers to buy an inappropriate dose for their age group. Thus, all prices are based on 50 TSH per pill, about US$0.04, of Coartem. The final SRP created through this process is 300 TSH or roughly US$0.25 for the 5- < 15 kg dose consisting of 6 pills, 600 TSH (US$0.50) for the 15- < 25 kg dose consisting of 12 pills, 900 TSH (US$0.75) for the 25- < 35 kg dose consisting of 18 pills, and 1200 TSH (US$1) for the 35+ kg dose consisting of 24 pills.

Methodology

A baseline dataset was established in all three districts before implementation in August 2007 and on a roughly quarterly basis since initiation of distribution. Two full datasets were collected and analyzed in November 2007 and March 2008.

Four methods were used to gather data to evaluate the impact of the pilot:

1. *Exit interviews*—Trained data collectors positioned themselves near an operating *duka la dawa baridi* administered a structured questionnaire to consenting customers who had purchased an antimalarial or antipyretic to gain insight into consumer product selection and perceptions and price paid for antimalarials, among other information.
2. *Retail audits*—Data collectors recorded the total volume of antimalarials and antipyretics stocked in the shop and interviewed the owner about new purchases or disposals (i.e., of expired products) in the past month. This information was compared to the volume stocked at the shop one month beforehand to arrive at the total sales.
3. *Mystery shoppers*—Data collectors posing as young adults seeking treatment for themselves or their young child (encounters are equally divided between the two scenarios) visited shops and purchased antimalarials according to a set algorithm.
4. *Public facility audits*—All public facilities were visited and data captured from official records on volumes of ACTs dispensed and stock-outs during the preceding period.

Data were recorded from all *duka la dawa baridi* and public health facilities in the districts so no sampling of outlets was required. The GPS coordinates of all shops were recorded using Garmin Etrex handheld equipment, enabling data to be linked to each shop between collection periods. These coordinates were also used to analyze key outcomes by shop location and competition level. Each shop was assigned a competition index (CI) based on the number of others within one kilometer, with categories ranging from 0 to 5. This approach assumes that a provider's market is defined as the area surrounding it of a given radius. Thus a shop with no competitors in the radius was classified in category 0, and one with four fell into category 4. GPS maps reveal that competition index is highly correlated with population density, with higher levels of competition typically found in towns and village centers.

Results

Stocking and Availability of ACT

In the November 2007 retail audit, one month after the launch of subsidized ACT distribution, 87 of 159 (55 percent) *duka la dawa baridi* in Kongwa and Maswa were stocking subsidized ACTs. After five months, this number had increased to 60 percent (n = 146), a statistically insignificant change. Stocking was higher in Kongwa than Maswa in both periods. In addition, the difference in stocking of ACTs by competition index category (χ^2 (1) = 20.855, $p < 0.001$) was significant: 80 percent in CI categories 4 and 5 had ACTs in stock in March compared to 38 percent in categories 0 and 1. Stocking of the most common alternative antimalarial, SP, declined significantly in Maswa ($p < .001$) and insignificantly in Kongwa. Only 6 percent of shops in all districts stocked an artemisinin monotherapy and no subsidized ACTs were found in stock in the control district.

Uptake of Subsidized ACTs

Of the 290 consumers interviewed after purchasing antimalarials in March, 44 percent bought subsidized ACTs, a significant increase over the less than 1 percent at baseline. The proportion seeking treatment for children under five rose from 40 percent (23 of 58) in November to 62 percent in March (50 of 81). By comparison, the proportion purchasing ACTs in the control district remained constant from baseline at less than 1 percent. Retail audits indicate that total monthly sales of subsidized ACTs increased from 1,663 in November to 8,932 in March, causing ACTs' share of overall antimalarial sales to grow correspondingly from 6 percent to 31 percent. The majority of subsidized ACT sales, however, continue to be in more densely populated areas: in March, 68 percent were by stores in CI categories 4 and 5.

In both intervention districts (see table 2), subsidized ACTs have increasingly replaced other common therapies. Exit interviews reveal that purchases of SP and AQ declined from 45 percent to 30 percent and from 19 percent to 17 percent respectively between August and March (see table 2). In the control district, purchasing patterns have remained largely consistent from the baseline in August, with no interviewed consumers obtaining ACTs and the majority buying SP (75 percent) or AQ (21 percent) in March. Sales of artemisinin monotherapies were minimal in all districts, with only 49 doses (0.3 percent) sold in the month preceding the March collection.

Price

In both the November and March data collections, interviewed consumers bought subsidized ACTs at competitive prices. Prices reported remained consistent from baseline, with the mean price for a full adult dose of SP ranging between 500 and 700 TSH ($0.42–$0.58) and AQ between 400 and 500 TSH ($0.33–$0.42). In comparison, consumers paid $0.51 on average for subsidized ACTs in March, which is 95 percent less than the previous retail price (~$10).[3] No evidence has been found of retailers engaging in price gouging: no consumer has paid more than $1, the suggested retail price for an adult dose, for a subsidized ACT. There was no significant correlation between the price consumers paid for antimalarials, including subsidized ACTs, and the competition index category of the store ($F = 0.579$, $p = 0.678$).

The SRP appears to have reduced the overall price variation of subsidized ACTs, but inflated the price of adult doses above the market rates charged in Maswa. Almost all (93 percent) consumers in Kongwa paid exactly the recommended price for subsidized ACTs. In contrast, wide variation of ACT prices was observed in Maswa, with consumers paying between 300–900 TSH ($0.25-$0.75) for an adult dose and between 200 and 800 TSH ($0.17–$0.67) for an infant dose. However, the recommended price for the adult ACT dose in Kongwa (1200 TSH) was nearly double the rate charged to date in Maswa (595 TSH).

Shopkeeper Behavior

Shopkeepers appear to consistently promote subsidized ACTs: an ACT dose was the first drug offered to 42 percent of all mystery shoppers in November and 48 percent in March. Most interviewed consumers (88 percent) purchased an appropriate full dose of subsidized ACTs for the reported age of the patient.

[3]As observed in private pharmacies in Dar es Salaam. No ACTs from originator manufacturers were found in study districts.

Significantly fewer ($p < 0.01$) buying SP and AQ bought an appropriate dose (76 percent and 78 percent respectively).

Consumer Characteristics and Perceptions

The majority of consumers (69 percent) seeking treatment from *duka la dawa baridi* in all three districts purchased antimalarials for themselves or another adult. The proportion purchasing treatment for children under five rose significantly in both Maswa (from 11 percent to 31 percent) and Kongwa (10 percent to 26 percent) between August and March ($p < 0.01$). This proportion remained roughly constant at 18 to 21 percent in the control district over the same period. The most common reason for purchasing subsidized ACTs cited by consumers in March was the perception that they are the most effective products to cure malaria (29 percent), up from 12 percent in November. Other frequent reasons given include having a prescription (21 percent) and the seller's recommendation (17 percent).

Discussion

The Tanzania pilot is the only project to date specifically designed to test the impact of a subsidy introduced at the top of the normal private sector supply chain, the model that would be used by the AMFm. Most other projects include substantial involvement by either the government or NGOs to complement or manage the distribution of ACTs by the private sector. In Tanzania, there is no contact between project organizers and the businesses in the supply chain following the sale of ACTs, which reduces the potential of Hawthorne Effect in which subjects change their behavior out of awareness they are being studied. There are notable limitations to the study design, including the small area, relatively short implementation time, and the collection of data at providers only (rather than at household level). However, though caution should be taken in drawing broad conclusions, the data indicate important lessons for the AMFm and other large-scale subsidies.

The initial results on the key outcomes of the pilot, uptake, and price of subsidized ACTs, are promising. After five months of implementation, just fewer than half of all consumers visiting *duka la dawa baridi* are buying ACTs rather than older therapies. This shift is more pronounced for those seeking treatment for children under five, at nearly two-thirds. Purchase of ACTs in the control district, however, has remained negligible since baseline.

ACTs were previously unavailable or sold for as much as $10, and consumers are now paying the same as or less than common alternatives such as SP. No evidence was found of businesses applying excessive mark-ups on subsidized ACTs as they move through the supply chain. The World Health Organization defines access to essential medicines as encompassing higher availability, reduced prices, better geographical access and higher acceptability of the product (WHO 2004). As a result, according to this definition, though overall ACT coverage in the districts was not captured in this study, the subsidy has substantially increased access to ACTs.

The pilot has also highlighted several challenges that should be taken into consideration in the design of similar interventions. Although more than half of shops in the intervention districts stocked the product within the first month, by the second data collection that supply had increased very little. The shops that do stock the product are highly clustered in population centers. By contrast, fewer than a third of the shops defined by competition index as more remote stocked it in March, whereas nearly two-thirds (62 percent in March) stocked other antimalarials, such as SP. This suggests that a primary driver of the

lower ACT supply is the distribution chain used in the pilot. Whereas dozens of wholesalers and distributors sell other antimalarials, only one wholesaler and two distributors officially distribute subsidized ACTs. Because remote shops have higher costs to obtain drugs (i.e., travel to town centers) and limited capital to make bulk purchases, they are particularly affected. The lower supply may also be affected by demand factors such as less awareness of the new product among businesses and consumers in remote areas. It will therefore be important to observe whether the trend continues as the project progresses.

Experience also indicates that applying an SRP can help control retail prices but can also be counterproductive if not calculated carefully. All but six (93 percent) consumers and mystery shoppers in Kongwa district paid the SRP for subsidized ACTs, but prices in Maswa varied. At the same time, however, consumers paid substantially more for the adult dose in Kongwa, suggesting that the SRP is set above the normal market rate. This illustrates the challenges of arriving at an SRP that is both affordable for customers and profitable for businesses, and suggests that detailed analysis of the supply chain and demand elasticity should be conducted before setting such prices for larger subsidy initiatives. With financing from the Global Fund, Tanzania is now aiming to expand the distribution of subsidized ACTS to the entire country over the next two years. The results of the pilot are a basis for cautious optimism that the initiative will have a considerable impact on ACT coverage and malaria mortality.

Kenya

Kenya is a malaria endemic country, with 77 percent of the population at risk of the disease. About one-quarter of hospital deaths and 40 percent of outpatient consults are attributable to malaria (WHO 2003). As part of its overall malaria control strategy, the Kenyan government adopted artemether-lumefantrine (AL) as the first-line treatment for uncomplicated malaria in 2006, introducing the drug to government health facilities free of charge in July of that year. Since then, a nationwide campaign employing mainly radio and television spots has been conducted to inform the public on the importance and proper use of AL.

A substantial number of Kenyans seek treatment for malaria outside the formal public health system. According to one recent household survey, of the 90 percent of caregivers who took some action to treat a child's fever within 48 hours of symptom onset, 47 percent first sought treatment in the private retail sector. In total, only 23 percent were treated with an antimalarial within 48 hours and only 10 percent received AL as recommended. As expected, the majority of AL (95 percent) was dispensed from public health facilities, though a July 2007 survey showed that 34 percent of government health facilities (GHF) had run out of the drug in the preceding six months (Amin et al. 2007).

In an effort to increase access to ACTs, an initiative was launched in 2007 to make AL available through private shops in targeted rural areas. These Community and Family Wellness (CFW) shops, which operate through a franchising system organized by the Sustainable Healthcare Foundation (SHEF), are staffed by a trained health worker and provide a range of health services in the community.[4] As part of

[4] A franchise arrangement with the Kenya-based NGO Sustainable Healthcare Foundation (SHEF) provides quality-assured drugs and other essential health products to the outlets. SHEF establishes uniform, affordable prices for tests and procedures—and provides those for ACTs, in conformity with Kenyan government guidelines, at no cost. SHEF also provides training and supervision to shop owners and health-care providers. The SHEF franchising system started in 1999 with 11 drug shops and is currently running 65 outlets in 10 districts of Kenya. There is a target of expanding the program to 225 outlets by 2012.

this initiative, AL is distributed to CFWs from the government central medical stores and administered free of charge to patients with uncomplicated malaria after confirmation by an RDT. Patients must pay $0.65 for a consultation and RDT before receiving AL for confirmed malaria. Patients with a negative RDT are either screened for other diseases (such as ear infections, measles, or an upper respiratory tract infection) at CFW clinics or referred to GHF for further assessment. To inform potential scale-up of the approach, impact and quality of ACT distribution were documented and evaluated.

Methodology

The intervention was implemented in Central Kenya, where malaria is holo-endemic. Nine CFW shops in three districts participated in the study: five in Embu, three in Kirinyaga, and one in Mbeere. These shops were selected by SHEF from a total of 36 on the basis of high malaria morbidity and disease burden (after a parasitological survey to determine malaria prevalence), capacity of the shop to assimilate new products, and current business performance. The participating shops were upgraded to clinics through the recruitment of a qualified nurse (if the owner was not already a nurse) to dispense ACTs. Given the prescription-only status of AL, the Pharmacy and Poisons Board mandated that CFW clinics were supervised monthly by pharmacy assistants to monitor appropriateness of drug use.[5]

Quantitative and qualitative household surveys were performed at baseline (December 2006) and after 15 months of the intervention (March 2008) to assess the quality of care provided by CFW clinics and consumer uptake and perception of subsidized ACTs. Household recall interviews were conducted to explore health-seeking behaviour of patients of all ages in cases of suspected malaria episodes within the previous two weeks (425 patients at baseline, 1143 at evaluation). To complement the household surveys, in-depth interviews were conducted with franchisees and other stakeholders and gender-specific focus group discussions were carried out with caregivers and the general population. Purposive sampling was used to select the respondents based on whether they had experienced malaria-like symptoms in the past month.

Results

Health-Seeking Behavior

At baseline, 97 percent of the 425 interviewed patients with symptoms of malaria in the previous two weeks had been treated with an antimalarial. This did not change. The percentage of patients seeking treatment from public health facilities, however, increased from 60 percent (95 percent CI 55–65 percent) at baseline to 69 percent (95 percent CI 66–72 percent) following the intervention, while those accessing treatment through the private sector declined from 50 percent (95 percent CI 45–55 percent) to 39 percent (95 percent CI 36–41 percent) over the same period.

ACTs at Private Clinics

CFW clinic registers show that as of September 2007, nine months after the launch of the initiative, 2,086 patients with a positive RDT were treated at the nine target clinics. The RDT positivity rate of patients seeking treatment at CFW clinics during this period was 36 percent. An additional 288 patients

[5] Currently, AL is still a prescription only medicine in Kenya, but the Ministry of Health is considering moving it to an over-the-counter medicine.

referred from GHFs with evidence of parasitological positivity were provided with AL at the CFW clinics (see table 3).

ACTs to Treat Malaria

Before the intervention, most of the 414 patients who sought treatment for malaria symptoms and received an antimalarial were treated with either SP (32 percent) or amodiaquine (27 percent), with only a few receiving AL (15 percent) or chloroquine (2 percent) (table 3). Fifteen months into the intervention, AL had become the most commonly obtained product, with 457 of the 1,092 (42 percent) interviewed patients receiving it. Of those, 393 (86 percent) obtained the drug from GHFs, 42 (9 percent) from CFW clinics, and 23 (5 percent) from other sources. These figures represent significant increases in both overall use of AL to treat malaria ($p < .001$) and the proportion of patients who accessed AL from public facilities ($p < .001$).

Adherence to Treatment

There was no significant difference between the proportion of patients who took AL the same or next day at baseline (34 percent, CI 23–46 percent) and following the intervention (47 percent, CI 42–51 percent). Similarly, no significant difference in promptness of treatment was found between patients obtaining AL from CFW clinics and public facilities (40 percent versus 47 percent).

According to household interviews, 94 percent of the 457 patients who received AL before the evaluation received the correct dosage, and 91 percent reported taking the correct dose of AL twice a day for three days. This was not verified by observation of packages or other methods. However, 9 percent of the respondents acknowledged that they did not follow the nurse's prescription. The reasons cited included improved symptoms, pill burden, a complex dosage schedule, lack of a paediatric formulation, and forgetfulness. No significant difference in reported adherence to the AL treatment schedule was observed between patients having obtained AL from GHF and from CFW clinics.

Quality of Care at Clinics

All CFW clinics reported full adherence to stipulated treatment guidelines. A higher proportion of patients treated at CFW clinics (71 percent, CI 58–85 percent) received AL based on their weight in accordance with national guidelines compared to patients treated at public facilities (52 percent, CI 47–57 percent). According to women participating in focus group discussions, the CFW clinics took special care to weigh the children, while other facilities often assessed weight using antenatal cards. Adherence to another treatment guideline, observance of the first treatment dose, was also higher at CFW clinics than public facilities (60 percent, CI 45–74 percent versus 37 percent, CI 32–42 percent).

Access to Clinics by Age

Although the small number of observations prevents robust analysis of the difference in ACT access by age, the data indicate a trend towards greater use of CFW clinics by older children and adults. Of the 42 patients receiving AL from CFW clinics at evaluation, the majority (88 percent) were children over five or adults, and only a few were children under five (12 percent). Children under five, however, made up 20 percent of those receiving AL from other sources.

ACT and RDT Acceptability and Cost

Almost all malaria patients who sought treatment at the CFW clinics (98 percent) reported that they intended to use AL in the future. In interviews, the large number of pills and recommended dietary requirements (i.e., taking pills with fatty foods) were the two primary obstacles cited.

CFW clinics were instructed to provide AL free but to charge the patient $0.65 for consultation and RDT. No data were collected on the actual compliance with this policy. Interviews revealed that patients viewed the consultation fee as a payment for the medicines. More than half reported that they paid for the drugs. Of those who reported paying, 70 percent perceived the price to be fair or cheaper than expected. Many respondents, however, expressed concerns about the cost of the RDT, particularly in the case of a negative test when further testing was required. As a result, some respondents reported purchasing drugs from other private outlets to avoid the testing costs.

In-depth interviews with CFW clinic health providers revealed that patients at times questioned the accuracy of RDTs, claiming that they later tested positive for malaria through microscopy conducted elsewhere. Some interviewees also raised concerns that RDTs were HIV tests and that their status would be available to the CFW staff without their knowledge.

Discussion

Subsidized ACTs were introduced into CFW clinics on a small scale to better understand the potential impact on patients who seek malaria treatment in the private sector and to inform the potential of this model and similar approaches in other countries. Overall, the distribution of ACTs through CFW clinics were found to have contributed to less than 10 percent of the increase in total ACT coverage observed after 15 months of intervention. Although important, this contribution is relatively minor in the face of targets of reaching more than 80 percent of patients with ACT treatment. There are several potential explanations for this modest impact.

First, access to antimalarial treatment was relatively high at baseline (60 percent) and increased during implementation (to 69 percent) as the result of an intense health education and medicine distribution campaign of the Kenyan government. The impact of private sector treatment interventions will always partly depend on conditions and developments in the public sector. Second, the cost of care at CFW clinics may have played a role. CFW clinics required an RDT at a cost of $0.65 before providing treatment, whereas in government facilities RDTs are not administered to children and care for children under five is supposed to be free of charge. This may have contributed to the lower use of CFW clinics for malaria treatment for young children. In addition, as common alternative antimalarials cost substantially less than this consultation fee (e.g., one study found SP sells for $0.38 on average), some patients may have sought treatment from other private retailers (Amin and Snow 2005).

A third factor contributing to the modest impact of the intervention was the limited number of included outlets. Only nine CFW shops (25 percent) were provided with subsidized ACTs versus an estimated 214 public and mission health facilities and hundreds of other private retail outlets in the districts (Noor 2008; Amin and Snow 2005). As such, the CFW clinics are less accessible and accordingly treat a minority of cases. Last, and in contrast to the comprehensive campaign that promoted AL at government facilities, no widespread communication was conducted to increase awareness of ACT availability in CFW clinics. Awareness that ACTs were available in the private sector may therefore have been low outside of the communities immediately surrounding the clinics.

This evaluation does show that CFW clinics are capable of providing high quality care for malaria patients. Key practices that contribute to proper dosing and adherence were regularly followed and compliance with national treatment guidelines was greater than at public facilities. In addition, though the impact of RDT provision on treatment was not part of the evaluation, the data clinic records provided suggest that a substantial number of patients tested negative and either received other care or were referred to a public facility. This is in contrast to most private shops and public facilities in Kenya and other countries, which usually treat presumptively, leading to considerable provision of drugs to patients without clinical malaria (Hamer et al. 2007). Overall, however, this experience suggests that if Kenya wants to substantially increase ACT use among patients seeking malaria treatment outside the public sector, CFW clinics will need to be complemented by distribution through more prevalent private outlets.

Cambodia

In Cambodia, malaria remains a health risk for an estimated 2 million people (14 percent of the population) who live or work near the thick tropical forests. Despite increased coverage of control measures in recent years, more than 60,000 cases were reported in the public health system alone.

Cambodia was the first country to switch to an ACT, a loose combination of artesunate and mefloquine (AS+MQ), in 2000 (World Health Organization 2002). The combination was co-blistered and packaged locally in different age-weight packages for adults and children and provided for free through public health facilities as A+M. To reach the most remote and affected populations, trained community-based volunteers called Village Malaria Workers (VMWs) provide free diagnosis with RDTs and treatment with A+ M in 400 endemic villages, mainly in Eastern Cambodia.

The majority of patients in Cambodia, however, seek treatment for fever outside of the public health system, with more than 70 percent visiting private providers instead (National Institute for Public Health 2005; Yeung et al. 2008). The private sector is poorly regulated and consists of a wide range of formal and informal outlets of varying quality. Diagnosis is often presumptive and there is widespread availability of artemisinin monotherapies and sub-standard and fake drugs (Rozendaal 2001; Newton et al. 2003; Dondorp et al. 2004; Yeung et al. 2008). To address this situation, the European Commission initiated a social marketing program in 2000 to sell subsidized AS+MQ. A *P. falciparum*-specific RDT was also socially marketed and sold separately in boxes of ten at a subsidized price. This program began as a two-district pilot in 2002 before scaling up to reach 17 endemic provinces and being transferred to the NGO Population Services International (PSI) and financed by a grant from the Global Fund in 2003. In 2004, sales were briefly interrupted as the brand names were changed (to Malarine® for ACTs and Malacheck® for RDTs) and prices reduced.

PSI is responsible for the procurement, blister-packaging, and marketing of Malarine and Malacheck. PSI-trained sales representatives directly distribute the products to a network of wholesalers in 17 out of 20 malaria endemic provinces. Both registered and unregistered private providers can purchase supplies from PSI representatives or wholesalers. PSI also trains private providers on appropriate diagnosis and treatment as well as on communication and education through mobile video unit shows, mass media, and special events, among others.

Methodology

There were no formal evaluations and no baseline survey before the ACT/RDT social marketing program. The results presented have therefore been drawn from a number of surveys conducted by different investigators before and after the nationwide scale-up and from discussions with key informants. Methodologies differed between surveys, making it important to exercise care in the interpretation of results.

In 2002, before the social marketing program was launched nationally, two cross-sectional studies had been undertaken on community drug usage in malaria endemic provinces. The first, conducted by the Mahidol-Oxford Tropical Medicine Research Unit (MORU) in conjunction with the Cambodia National Malaria program (CNM), compared access to AS+MQ in areas with and without supporting interventions (Yeung et al. 2008) and included interviews with 316 respondents with a recent history of fever. The second, the Cambodian Drug Usage Survey (CDUS), aimed at documenting knowledge related to drug usage and behavior of providers and consumers. It included 1,277 household respondents and 156 drug outlets, of which 49 were in villages and 107 in markets (Cambodia National Malaria program/Cambodia Ministry of Health 2003).

Since the nationwide scale-up of subsidized ACTs in 2003, a number of surveys have been conducted, by PSI and other institutions. One, in 2004, was the Cambodia Malaria Baseline Survey (CMBS), in which a wide range of malariometric data were collected from household and drug outlets, including some information on the availability and use of antimalarial drugs. A stratified multistage sampling design divided the country into three domains by epidemiological features. Clusters were stratified by risk of malaria according to distance from forest. Selection of drug outlets was opportunistic. Of 90 village outlets and 45 market outlets, 80 villages and 43 markets were sampled. Of these, 61 were pharmacies or drug shops, 54 were general stores, six were drug sellers in an open market, and two were private clinics (National Institute for Public Health 2005).

Two survey reports are available from PSI: a 2006 TRaC (Tracking Results Continuously) survey and a 2007 MAP (Measuring Access and Performance) survey. The TRaC study consisted of a cross-sectional household survey conducted in June and July 2006. Stratified multistage sampling was used to collect data from 675 respondents living in villages classified under three domains (high, medium, and low risk of malaria) within the 17 provinces targeted by the social marketing program. The focus of the study was to investigate behaviors related to ITN use and diagnostic blood testing for malaria among residents of malaria endemic areas (Population Services International 2006).

Unlike the other surveys, the MAP study, conducted in September 2007, used Lot Quality Assurance Sampling (LQAS), in which the key outcome is whether a certain threshold has been reached (in this case whether at least 50 percent of shops in a community stock the ACT product). Nineteen communes[6] from each of the three domains within PSI's 17 target provinces were randomly selected and all eligible health[7] and nonhealth[8] outlets in the selected communes were audited for the presence of malaria-

[6] Cambodia is divided into 1,621 administrative units, called *communes*, which usually represent four to seven villages.
[7] Malarine and Malacheck are supposed to be sold only in health outlets. PSI defines health outlets as those that "specialize in selling health products. They include drug stores, cabinets, pharmacies, clinical pharmacies, SQHN clinics, and mobile providers."(Population Services International 200X).
[8] PSI defines nonhealth outlets as those that "typically sell a combination of products from household items to groceries. They include grocery/convenience stores, village shops, market stalls, and mobile net sellers." (Population Services International 200X).

related products marketed by PSI, including Malarine and Malacheck. Additional information was also collected on a range of quality standards (Population Services International 2008).

Results

Availability and Supply of AS+MQ

From 2003 to 2006, PSI sales to private providers increased from 30,242 to 241,936 packs per year. In 2007, PSI sold 162,364 packs (14 percent for children under five and the remainder for adults), a 33 percent reduction in sales over the previous year. Data on the actual distribution and volume of sales from retail outlets to consumers are not available.

In 2004, a year after the nationwide launch of Malarine, the CMBS found that 22 percent of the sampled private sector outlets sold the adult doses, 6 percent sold the child doses, and 11 percent stocked Malacheck.

The 2007 MAP survey found that 44 percent of sampled communities met the LQAS threshold (at least 50 percent of shops stocking the product) for the adult AS+MQ dose, with penetration generally highest in high-risk areas (55 percent of communities). By comparison, 17 percent of communities met the threshold for the child dose, with few differences across the three risk areas. Few mobile providers were found selling Malarine. Malacheck market penetration was on average 42 percent among private outlets. Most pharmacies, cabinets, and drug stores but fewer mobile providers from medium and low risk areas sold the product.

The presence of expired stocks of either ACTs or RDTs was rare and products were usually stored correctly. However, stock-outs of both Malarine and Malacheck were common. Of the communities that met the stocking threshold, 60 percent reported a stock out of Malarine for adults and children. A stock-out is defined as at least one day without the product in the three months before the survey. The MAP report states that while the survey was being conducted, PSI's central warehouse was out of stock, which may have had an impact on availability among retailers. Information gathered through interviews indicates that delays in central-level procurement were another factor.

Cost of First-Line Drug and RDTs

In September 2004, after PSI conducted a willingness-to-pay study, the printed recommended retail price (RRP) for Malarine was reduced from 7500 riel ($1.88) for the adult dose and 4500 riel ($1.13) for the child dose to 2500 riel ($0.63) for a dose of either. The RRP for Malacheck is 1000 riel ($0.25).

The current recommended price for retail outlets to buy from wholesalers, distributors or sales agents is $0.55 per dose of Malarine and $0.22 per Malacheck test. The 2007 MAP study found that, in practice, there are large variations in prices retailers pay for the product. Outlets paid an average price of $0.75 (range $0.50 to $2.00) per dose of adult Malarine and $0.69 (range $0.50 to $2.00) per dose of child Malarine, 36 percent and 25 percent higher, respectively, than the recommended price. Malacheck was purchased for an average of $0.29 (range $0.19 to $1.25) per test.

In turn, retailers often sold the products to consumers above the RRP, charging an average price of $1.07 (range $0.63 to $3.75) for adult doses of Malarine and $0.95 (range $0.63 to $2.50) for child doses. Malacheck was sold at a mean price of $0.37 ($0.25 to $1.25).

Patient Awareness

Shortly after the nationwide launch of Malarine, 24 percent of household respondents in the CDUS claimed that they had heard of the drug. In the following year, 46 percent of CMBS household respondents reported that they heard of either Malarine or A+M**.**

Artemisinin Drug Usage

Results from both of the two drug usage studies conducted in 2002 indicate that fewer than 10 percent of febrile patients who sought treatment in the private sector received AS+MQ at the time. Use of artemisinin monotherapies was common and constituted more than 70 percent of treatment with artemisinin-based products.

The 2007 MAP study showed that of the 517 outlets surveyed, the most commonly stocked antimalarial was tetracycline (41 percent)[9], followed by artesunate monotherapies (19 percent). Of the 104 surveyed outlets that sold drugs in "cocktail" packages (a mixture of several loose drugs), 45 percent included artesunate and 13 percent contained artemether. Mefloquine was included in 21 percent. The study also showed that almost one-third of private providers had sold Malarine tablets individually by either removing or cutting tablets from the blister pack (29 percent for the adult doses and 26 percent for the child doses).

Diagnosis

In the 2002 surveys, household respondents reported that only 18 percent of interactions between private providers and patients with recent fever resulted in a biological diagnosis. In the 2006 PSI TRaC study, 64 percent (n = 309) of respondents reported taking a diagnostic blood test the last time they had symptoms, and 34 percent reported generally ("always/often") doing so. Because the 2006 PSI study included consultations with public as well as private providers, and during this time there was an increase in diagnosis in the public sector, these two sets of results are not directly comparable.

Discussion

Cambodia was the first country to pilot and then scale up the provision of subsidized ACTs in the private sector. It did not, however, collect and analyze formal baseline and follow-up data, which limited any comprehensive evaluation of the program. However, a number of studies and surveys have been conducted before and during the program. General conclusions are possible, but survey sampling strategies differed and were not necessarily representative of the country or of malaria-endemic areas. In particular, the private drug outlets in the CMBS study were convenience sampled, introducing potential bias, and the outlets in the MAP study were sampled using the LQAS technique.

Awareness of Malarine and Malacheck among providers and consumers appears high, following several years of social marketing activities. Market penetration rates, however, are only just above 40 percent for Malarine and Malacheck. Supplies of the products are irregular and provider stock-outs frequent (Population Services International 2008). Further research is needed to clarify the extent to which low stocking levels are attributable to difficulties obtaining supplies versus a lack of consumer demand. The

[9] Tetracycline is usually used as an antibiotic but has antimalarial properties and in Cambodia is the recommended second-line treatment in combination with quinine.

observed trend that providers consistently sell both ACTs and RDTs above their RRP likely reduces the equity of access and may be driven by a number of factors. First, because the products were available for several years at substantially higher prices before PSI reevaluated the pricing, providers and consumers may still associate the products with these price levels and charge or pay accordingly. Second, the irregular supply may have enabled providers to charge more when products are available assuming adequate demand. Last, consumers' price elasticity for the products may be higher than estimated or the providers' margin from the RRP is limited, enabling them to generate greater revenue by selling fewer products at higher prices.

Malaria transmission in much of Cambodia is very low with a yearly decline in cases of *P. falciparum* (Cambodia National Malaria Program/Cambodia Ministry of Health/and partners 2008). Most fevers, especially in western Cambodia, where drug resistance is worst, are not due to falciparum malaria, and therefore do not need to be treated with artemisinin drugs. Although RDTs have been marketed for several years, availability and uptake of biological diagnosis is still low. The MAP study found that the strongest determinant of a patient with fever using a diagnostic test for malaria was being offered a test by the provider. This suggests that ensuring an adequate and reliable supply of affordable RDTs and properly training and motivating providers to dispense them are essential. In addition, further operational research to assess and explore ways to increase the proper usage of RDTs is warranted given the poor adherence to guidelines observed in other settings (Reyburn et al. 2007).

Given the challenges in stocking and uptake of ACTs and the apparent declining incidence of malaria, the most effective way of increasing access to high quality ACTs and diagnosis may be to provide both at no cost through trained village volunteers (Yeung et al. 2008). This scheme is now being expanded to include lower transmission areas and should be thoroughly evaluated to ensure maximum coverage and efficiency in light of the low parasite prevalence rates. Regardless of progress in this initiative, however, a large proportion of patients will continue to seek treatment in the private sector. With use of artemisinin monotherapies at these outlets high, and with resistance to artemisinin apparently emerging in the region, it is imperative that a comprehensive approach to private antimalarial treatment in Cambodia be implemented in the near future (2007).

Senegal

Malaria is endemic throughout Senegal. An estimated 1.5 million cases occur each year, accounting for 30 percent of outpatient visits and 25 percent of hospital deaths in children under five (Senegal National Malaria Control Program 2006; President's Malaria Initiative 2008). There are signs, however, that recent efforts by government and partners have yielded positive outcomes: although malaria-related morbidity has not changed between 2000 and 2005, the proportion of attributable infant mortality dropped from 30.2 percent to 20.7 percent (Republic of Senegal 2007).

In 2005, Senegal changed its first-line treatment for uncomplicated malaria to the ACT artesunate-amodiaquine (AS+AQ). In April 2006, with support from the Global Fund, the government medical stores (Pharmacie Nationale d'Approvisionement—PNA) procured its first consignment of 3 million courses of AS+AQ for national distribution that year. In January 2007, it received a second consignment of 3 million for the following year. The number of doses exceeds estimated malaria cases because a large number of fever cases were treated as suspected malaria (Republic of Senegal 2007). Treatment for malaria occurs primarily in the public sector, where an estimated 75 percent of patients seek treatment from public facilities (Thior 2008). In line with the cost-recovery system for essential medicines in the country, public

facilities charge 600 F CFA ($1.29) for an adult dose of AS+AQ and 300 F CFA ($0.65) for child and infant doses. To supplement treatment access in the public sector, the government launched the distribution of subsidized AS+AQ through private pharmacies in September 2006. AS+AQ was assigned a suggested retail price (SRP) to match that of the public sector.

Methodology

Data presented in this report were gathered one year after distribution of subsidized ACT began in the private sector. The Institute for Research and Development led the design and implementation of this evaluation, which centered on four primary methods: a pricing survey based on the Health Action International-WHO methodology, mystery shoppers, GPS mapping, and qualitative interviews with key institutions (the National Program to Fight Malaria, Ministry of Health, PNA, and private wholesalers) (World Health Organization/Health Action International 2008). The research was developed to answer key questions about the availability and pricing of ACT in the public, nongovernment, and private sector.

The HAI-WHO pricing survey covered a sample of public, nongovernment, and private sector outlets from both urban and rural areas of Senegal. Survey areas were selected based on population density and proximity to national borders. Outlets were identified by purposively selecting public health facilities and searching for all other outlets in the surrounding area. In the urban Dakar region and Mbour city (located 80 km south of Dakar), six public, five NGO, and 28 private outlets were identified from ten areas. In the rural areas of Takhoum (near an urban center), Niakhar and Ndangalma (removed from any major towns or roads), and Nioro (on a border), 12 public, three NGO, and 13 private outlets were identified. Because of the distances between outlets, the rural survey limited itself to private outlets located within a 10 km radius of an identified public health center.

Mystery shoppers visited stores in private pharmacies, 40 in urban areas and 110 in rural settings. On visiting a store, the mystery shopper presented a prescription for either an adult dose (44 percent) or child dose (56 percent). If the outlet did not stock AS+AQ, the shopper purchased the recommended alternative. In Senegal, an agreement between private pharmacies and wholesalers allows unsold medication with more than six months to expiration to be returned to the wholesaler for a refund. The ACT used for private sector distribution had a sell-by date of November 2007. As a result, June and July 2007 orders for ACTs were low. Because the data presented here were collected in August 2007, it is possible that stocking of ACT was unnaturally low because the product was soon to expire.

Results

Availability

The HAI-WHO survey found that overall stocking of AS+AQ in urban areas was higher in the public than in the private sector. Among public and NGO facilities, 83 percent (nine of 11) stocked all three doses. Among private outlets, only 7 percent (two of 28) did so. Stocking adult ACT was particularly high in public and NGO facilities (91 percent) and the child dose higher in private facilities (43 percent). By comparison, 96 percent of private shops stocked SP and 79 percent stocked chloroquine+proguanil. Stocking in rural areas followed a similar pattern, with all three doses more available at public and NGO facilities (67 percent) than at private shops (8 percent).

Stocking Level

Stocking levels of AS+AQ in urban areas were substantially higher in public facilities than in private shops, with an average of 85 doses for children under five per public facility, versus only 4 doses per private outlet. In addition, stocking at outlets in urban settings was higher than in rural ones: only 52 doses for children under five were found per public facility in rural areas.

Pricing

In urban areas, the outlet pricing survey found adult doses of AS+AQ on sale at private shops at an average of 621.32 F CFA ($1.34), which was similar to the observed public sector price of 606.22 F CFA ($1.31). The private and public sector selling prices for child and infant doses are also comparable, at 322 F CFA ($0.69) in the public and at 304.16 F CFA ($0.66) in the private sector. Prices reported from mystery shoppers at private shops are consistent with these findings. Shoppers paid on average 627.5 F CFA ($1.25) for the adult doses and 332 F CFA ($0.72) for the child and infant doses. Prices in rural areas followed these trends at an average of 615 F CFA ($1.33) for adult doses and 320 F CFA ($0.69) for child and infant doses in private shops.

As shown in table 5, the recommended price structure indicates that outlets should sell AS+AQ at a 30 percent mark up. Although mark-ups in the private sector appear to follow this policy, the purchase price for the private sector has been assumed to reflect government policy and was not verified.

Discussion

The relationship between the public and private sectors in Senegal differs substantially from many countries. Unlike in much of East Africa, an established system of the government medical stores distributes products to private for-profit outlets as well to public facilities. The distribution of ACTs through this system thus provides a unique opportunity to examine the experience of subsidy schemes. However, although ACTs have been distributed through private shops for roughly two years, no evaluation was built into the project and the exercise later conducted focused only on pricing and availability. The evidence gathered to date does not answer questions related to uptake of and access to subsidized ACTs. Moreover, the survey was conducted on a relatively small number of outlets over a short period. Despite limited data, useful lessons can be derived from this experience.

The most notable finding was the comparable pricing of AS+AQ in the public and private sectors. Because of the cost recovery system, public facilities receive AS+AQ from the central medical stores at a rate only modestly below the market price and in turn apply a small mark-up. Although private shops apply higher mark-ups to include profit margins, they buy ACTs at a lower price (though still modestly subsidized compared with other countries), which enables them to sell to consumers at the same level as the public sector. It is therefore interesting that stocking AS+AQ was considerably lower in private shops. It is impossible to determine without further data, but the dramatically higher rates of stocking of SP and other products by private shops suggests the continued high price of AS+AQ compared to these alternatives limited consumer demand. Private businesses appeared to consistently apply reasonable mark-ups on the subsidized ACTs. Consumers paid only 4 percent more than the RRP for the adult dose of AS+AQ on average, and the highest price observed was only 4 percent above that average.

Lessons Learned

The case studies examined here provide an initial picture of the impact and challenges that can be expected as the global malaria community devotes increased attention and resources to delivering ACTs through the private sector. Although the limited data prevent broad conclusions, the experiences of these countries can provide valuable lessons to guide policymaking. Indeed, a number of important themes emerge from analysis across the countries.

Subsidies and the Private Sector

The Kenya and Tanzania studies indicate that subsidy programs can lead to more rapid uptake of ACTs among individuals seeking treatment at private outlets. In Tanzania, the proportion of consumers purchasing ACTs rose more than forty-fold after five months. The lack of change in ACT purchasing in the control district during the same period confirms the role of the subsidy intervention in this increase. There was a similar change in Kenya. The increased uptake of ACTs led to a corresponding decrease in the use of other therapies such as SP and amodiaquine. Although neither study found substantial sales of artemisinin monotherapies at baseline, it can be inferred that these treatments would have similarly been crowded out by increased sales of ACTs, as has been assumed in the studies underpinning the AMFm (Laxminarayan et al. 2006).

The Cambodia experience presents an important exception to this trend. After five years of implementation, the most commonly purchased antimalarials at private shops were tetracycline and an artemisinin monotherapy, with use of ACTs appearing to rise only marginally. Although the available data are suboptimal and may underrepresent the uptake of ACTs at certain times during the project, evidence suggests that subsidized ACTs have not gained traction with consumers in Cambodia.

There are many possible reasons for the low uptake in Cambodia compared to the other countries, some of which are examined in greater detail below and in a forthcoming publication. The antimalarial environment is fundamentally different in Cambodia than in sub-Saharan Africa. Artemisinin monotherapies have been widely available for many years and consumers appear to perceive them to be safe and effective. There was thus little incentive for consumers to switch to the co-blistered A+M, as mefloquine is associated with unpleasant side effects. Unfortunately it is difficult to draw conclusions about price sensitivity from the available data. By comparison, consumers in East Africa were typically using SP and amodiaquine for which significant resistance has developed (Schonfeld et al. 2007). However, anecdotal evidence indicates that some patients prefer SP to ACTs because of its simpler dosing schedule, suggesting that the pricing and promotion of ACTs in those countries contributed to the more rapid uptake.

Outlets and Access

Another possible driver of the difference in uptake between the case study areas is the type of outlet. Here, the difference is most notable between Kenya and Tanzania. In Kenya, a limited number of franchised shops hired registered nurses and were upgraded to clinics to dispense ACTs and RDTs. By comparison, the *duka la dawa baridi* that distributed ACTs in Tanzania were often staffed by individuals with no formal medical education and only a two-day training on malaria and ACTs before the subsidy. Thus only nine shops across three districts distributed ACTs in Kenya, compared to 146 shops in two districts in Tanzania. This in turn led to radically different provision: shops in Kenya distributed 2,086

ACTs over nine months (232 doses per month on average) whereas those in Tanzania dispensed 8,932 doses in a single month. Subsidized ACTs in Cambodia are intended to flow through a range of private outlets approved to sell medicines, but because data are not linked to the types of outlets similar comparisons are difficult.

The principal reason for limiting the private outlets that can supply drugs is concern about quality of care provided and overtreatment with antimalarials. These studies provide limited but useful insight. In Kenya, the CFW clinics almost always dispensed the correct dose and followed treatment guidelines such as weighing children and observing the first dose more frequently than in public facilities in the area. Although these metrics were not captured in Tanzania, it is reasonable to assume that few shops engaged in these practices because they were not trained as comprehensively and the relevant equipment (e.g., scales) was typically not available. Shops in Tanzania did, however, dispense the correct ACT dose (according to age) almost as frequently as those in Kenya and there was little evidence of packages being split or opened. This finding is in line with other studies (Goodman 2004). Nevertheless, it appears that the clinics in Kenya consistently provide better care than the more informal shops in Tanzania. Less information was available on the appropriateness of ACT prescriptions and the role of diagnostics, including the impact of RDT use in Cambodia and Kenya. This is a critical topic for further research, particularly if ACT subsidies are to be introduced in areas with low or moderate malaria transmission.

These studies thus highlight the fundamental tension between access and quality in private sector ACT distribution that policymakers must grapple with as large-scale interventions are increasingly rolled out (Goodman et al. 2007). Many sub-Saharan countries take an approach similar to Kenya's, allowing ACTs to be distributed only through a limited number of outlets (e.g., pharmacies). At the same time, most other antimalarials are available over the counter from a wide range of outlets, including general stores. It is doubtful that introducing AMFm or any other large-scale subsidy intervention into a narrower private sector will have a dramatic impact on ACT access or use of monotherapies. Although some subsidized ACTs will undoubtedly be distributed illegally to other outlets, regulatory authorities will likely apply greater scrutiny to publicly financed subsidy interventions, dissuading wholesalers from distributing to smaller, unapproved outlets. This experience suggests that prescription-only ACTs and associated restrictions on outlets must be at the center of discussions on the AMFm, both within countries and across the global community.

Markups and Limiting prices

The markups placed on subsidized ACTs as they flow through the private supply chain have substantial impact on eventual uptake by consumers and are a considerable source of concern for policymakers. The evidence provided by the Senegal and Tanzania studies is generally optimistic in this regard. In Tanzania, consumers paid, on average, the same or less for subsidized ACTs as for the most common alternative antimalarials. In both Tanzania and Senegal markups on average were reasonable and the data indicate no instances of price gouging. Both studies found no correlation between the location of the shop and the price paid by consumers.

In contrast, in Cambodia, the average retail price for adult doses was 70 percent above the RRP and in specific cases, as much as six times higher. RDTs were similarly marked up above the RRP. As with ACT uptake, the reason for the difference between Cambodia and the other countries is unclear. All of the factors discussed, including consistent supply shortage and the initial introduction of the product at a

considerably higher RRP, likely had an influence. In addition, the differences in subsidy level and recommended price certainly played a role. The RRP in Tanzania was roughly 225 percent higher than the subsidized price at which the wholesaler reported selling ACTs to retailers. This difference provided consumers with a retail price equivalent to other antimalarials and the retailers with substantial revenue. By comparison, the RRP in Cambodia was roughly 15 percent higher than the recommended price, which may have generated inadequate revenue for businesses, creating incentives for them to raise prices and promote other more lucrative products. This issue reinforces the importance of global institutions and countries determining the optimal subsidy level and, if relevant, recommended retail prices.

The Senegal experience also illustrates an important reality of many countries. Discussion of strategies to increase ACT access often centers on a dichotomy of free public sector distribution versus charges in the private sector. The Senegal study, however, found that patients paid equivalent amounts for ACT treatment in the public and private sectors. Although this finding is particularly relevant in West African countries implementing the Bamako Initiative, charges at public facilities are common in many other malaria-endemic countries (Uzochukwu et al. 2004; Mubyazi et al. 2006; Hetzel et al. 2008). A recent study in Tanzania, for example, found that patients spent equally for malaria treatment from public and private sources (Hetzel et al. 2008).

Strategies and Settings

Ultimately, the most important question of any subsidy intervention is whether it increases overall coverage among patients. These case studies are not capable of robustly answering that question about ACTs and malaria. The data from Kenya and Tanzania provide rough initial indications, however. In Tanzania, the total number of ACTs dispensed by the public and private sectors in the study areas rose substantially between the data collection periods, with subsidized ACTs accounting for nearly half of that increase. The increase in Kenya was similar. That increase, however, was driven predominantly by increased distribution from public sector facilities, with the private sector accounting for a small minority. Although this may be in part because of the relatively few private shops dispensing ACTs in the study area, it highlights the considerable role that improvement of supply and promotion in the public sector can have on access. Consequently, though private sector interventions will be imperative to increasing access in some countries, in others, with limited resources and different epidemiology and patient behavior, impact may be greater through investment in improving public sector distribution.

These experiences suggest that private sector subsidies can play an important role in efforts to increase ACT coverage in many malaria-endemic areas, though additional operational research is needed to robustly discern impact and guide the development of optimal approaches. After only five months, two-thirds of consumers buying antimalarials for children under five in Tanzania are buying ACTs rather amodiaquine and other therapies, and businesses in both Tanzania and Senegal are applying reasonable markups. Above all, however, these studies emphasize the need for ACT distribution strategies to be carefully tailored to each country. Malaria affects many countries, each with largely unique epidemiology, demographics, health systems, and resources. In addition, potential private sector treatment interventions must take into account broad differences in treatment seeking behavior, private outlets, regulatory frameworks, and consumer preferences. Each country must engage in an independent process to decide if and how to pursue increased ACT access in the private sector, including through the AMFm.

Table 1. Current Distribution of ACTs through Private Sector

Country	**Lead**	**Type of ACT**	**Project Launch**	**Age group**	**Coverage**	**Outlets**	**Supporting interventions**	**M&E**
Cambodia	PSI	AS+AQ	2002	all five	17 provinces	pharmacies, drug shops	training, IEC, SRP, packaging	see table 4
Angola	government/ SMEF/ WHO-TDR	AL	TBD	< five	pilot study	private clinics, pharmacies, community agents	training, IEC	TBD
Kenya	government	AL	Dec. 2006	all	3 districts	pharmacies, clinics	outlet upgrade, regulatory supervision, diagnosis	baseline Dec. 2006; 1-year study in Mar. 2008
Senegal	government	AS-AQ	Sept. 2006	all	national	private sector pharmacies	SRP	Nov. 2007
Tanzania	government/ CHAI	AL	Oct. 2007	all	2 districts	drug shops	training, IEC, packaging, SRP	baseline Aug. 2007. Quarterly for 1 year
Madagascar	PSI	AS-AQ	2003	< five	national	pharmacies, private providers, community agents	training, IEC, packaging, SRP	late 2008
Nigeria	government/ PSI-SFH	AL	2006	< five	targeted districts	pharmacies, drug shops, and PPMVs	training, IEC, packaging	May 2008
Rwanda	PSI	AL	2007	< five	~22 districts	pharmacies	training, IEC, packaging	outlet survey Feb. 2008; HH survey May 2008
Myanmar	PSI	AL	June 2003	all	ended 2005	clinic franchises	training, IEC, packaging, with rapid diagnostic test	HH and outlet surveys 2008
Uganda	government/ MMV	AL	Sept. 2008	all	6 districts	drug shops, clinics	training, IEC, OTC rescheduling, packaging, SRP, upgrading outlets, pharmacovigilance	supply and HH surveys Aug 07; baseline: Sept 2008; quarterly for 1 year
Kenya	government/ PSI	AL	Oct. 2008	< five	3 districts (selected locations)	drug shops and general stores	training, IEC, packaging	cluster randomized study; baseline mid 2008, evaluation at one year

Table 2. Consumers Purchasing Antimalarials				
		Baseline (August)	**One month (November)**	**Five months (March)**
Total exit interviews		n = 417	n = 297	n = 290
Adults (ages 16+)	**Product selection**			
	Any antimalarial	323 (77%)	228 (77%)	192 (66%)
	ACTs	4 (1%)	90 (30%)	66 (34%)
	SP	213 (66%)	133 (45%)	82 (43%)
	AQ	81 (25%)	57 (19%)	28 (15%)
	Art monotherapy	0 (0%)	3 (1%)	2 (1%)
	Price (mean/range)			
	ACTs	N/A	$0.50 ($0.42—$1.00)	$0.66 ($0.25—$1.00)
	SP	$0.65 ($0.13—$6.67)	$0.44 ($0.08—$1.00)	$0.56 ($0.25—$3.13)
	AQ	$0.33 ($0.13—$2.50)	$0.42 ($0.33—$0.67)	$0.36 ($0.08—$0.67)
Children Under Five	**Product selection**			
	Any antimalarial	44 (11%)	58 (20%)	81 (28%)
	ACTs	0 (0%)	23 (40%)	50 (62%)
	SP	3 (7%)	6 (10%)	5 (6%)
	AQ	39 (89%)	27 (47%)	19 (23%)
	Art monotherapy	0 (0%)	0 (0%)	0 (0%)
	Price (mean/range)			
	ACTs	N/A	$0.25 ($0.17—$0.83)	$0.32 ($0.17—$0.67)
	SP	$0.31 ($0.25—$0.42)	$0.46 ($0.08—$0.46)	$0.55 ($0.25—$3.13)
	AQ	$0.88 ($0.13—$1.25)	$0.71 ($0.13—$1.25)	$0.56 ($0.08—$1.67)

Table 3. Coverage of AL in Intervention Districts in Kenya

	Baseline (December 2006)	**Evaluation (March 2008)**
Surveyed patients receiving any antimalarial	414	1105
Patients receiving AL	64 (15%, 95% CI 12–19%)	457 (42%, 95% CI 39–45%)
From public facilities	41 (64%, 95% CI 52–76%)	393 (86%, 95% CI 83–89%)
From CFW clinics	0	42 (9%)
From other sources	23 (36%, 95% CI 24–48%)	23 (5%, 95% CI 3–7%)

Source: To come

Table 4. Major Surveys on ACT Distribution in Cambodia

Survey	Implementer	Study content	Data collection and sampling	Coverage	Dates
Access to ACTs in remote areas of Cambodia	MORU and CNM	Treatment seeking behavior and antimalarial usage with and without supporting interventions	HH survey, purposive sampling of areas and random sampling of villages	Thai-Cambodia border	July-September 2002
Cambodia Drug Usage Survey (CDUS)	CNM and partners	Overall antimalarial usage	HH and drug outlet survey, stratified multi-stage sampling design	Thai-Cambodia border	October 2002
Cambodia Malaria Baseline Survey (CMBS)	CNM and partners	Baseline malaria indicator survey including prevalence	HH and drug outlet surveys, stratified multistage sampling design and opportunistic selection of drug outlets	All malaria endemic provinces	November-December 2004
Cambodia: Malaria Tracking Results Continuously (TRaC) Survey	PSI	Behaviors related to use of ITNs and diagnostic blood tests for malaria	HH survey and stratified multistage sampling	17 malaria endemic provinces targeted by PSI's malaria program	June-July 2006
Cambodia (2007): Measuring Access and Performance (MAP)	PSI	Coverage, market penetration and quality of coverage of PSI's malaria products	Drug outlet survey, LQAS technique to draw 19 communes from three strata (high, medium, low endemic areas)	17 provinces targeted by PSI's malaria program	September 2007

Source: To come

Table 5. Public and Private Sector AS+AQ Prices During HAI-WHO Survey

		RRP	Actual public (n = 18)	Actual private (n = 31)
Selling price	Adult	$ 1.29	$ 1.30	$ 1.34
	Child	$ 0.65	$ 0.65	$ 0.69
Purchase price	Adult	$ 0.99*	$ 1.26	$ 0.99*
	Child	$ 0.50*	$ 0.61	$ 0.50*
Mark up ($US)	Adult	$ 0.30	$ 0.04	$ 0.35
	Child	$ 0.15	$ 0.04	$ 0.19
Mark up (%)	Adult	30%	3%	35%
	Child	30%	6%	40%

*Purchase prices for private pharmacies from wholesalers have been set by the government. Prices indicated are assumed to follow government policy but were not confirmed and in practice may vary.

Source: To come

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RESOURCES FOR THE FUTURE

Consultative Forum on the Affordable Medicines Facility-malaria (AMFm)

25 – 26 September, 2008
Jurys Hotel Washington, Washington, D.C.

THURSDAY SEPTEMBER 25, 2008

9:00 – 10:00 am Registration and Breakfast

10:00 Welcome……Ramanan Laxminarayan
Resources for the Future

10:10 Introduction from the Chair……Barry Bloom
Dean- Harvard School of Public Health

10:20 am – 1:00 pm

Session 1: AMFm Issues for Discussion

Key elements of AMFm and introduction to issues (25 mins)……Ramanan Laxminarayan
Resources for the Future

Artemisinin use by pregnant women (35 mins) ……Nick White
Mahidol-Oxford Tropical Medicine Research Unit

Discussants (10 mins)……Karen Barnes
University of Cape Town

Ambrose Talisuna
Medicines for Malaria Venture

Diagnostic technologies for malaria (35 mins) ……Chris Whitty
London School of Hygiene and Tropical Medicine

Discussants (10 mins)……Wil Milhous
University of South Florida

Jean-Marie Kindermans
Doctors Without Borders

Discussion (45 mins)

1:00 – 2:00 pm **Lunch**

2:00 – 5:30 pm

Session 2: More Issues and Current Implementation Plans

Reaching the poorest of the poor (40 mins) ……Ricardo Bitrán
Bitrán and Associates

Discussants (10 mins)……Mogha Kamal-Yanni
Oxfam

Naawa Sipilanyambe
UNICEF

Pilot experiences to inform AMFm (40 mins) ……Oliver Sabot
Clinton Foundation

Discussants (10 mins)……Sonali Korde
USAID/PMI

Uzo Gilpin
Society for Family Health, Nigeria

Break (20 mins)

AMFm and the Global Fund (20 mins)……Jean-Paul Moatti
The Global Fund to Fight AIDS, Tuberculosis, and Malaria

Panel discussion: Current plans for AMFm (30 mins)……Olusoji Adeyi
The World Bank

Sergio Spinaci
WHO

Dean Jamison
University of Washington

Ambrose Talisuna
Medicines for Malaria Venture

Discussion and Adjourn (40 mins)

FRIDAY SEPTEMBER 26, 2008

8:00 – 9:00 am Registration and Breakfast

8:50 Welcome — Phil Sharp, President- Resources for the Future

9:00 Introduction from the Chair — Barry Bloom, Dean- Harvard School of Public Health

9:15 – 10:40 am
Session 1: The Development and Future Impact of AMFm

Challenge to concept: The global subsidy for ACTs (40 mins)……....Sir Richard Peto, Oxford University

Message from Kenneth J. Arrow, Stanford University

Concept to reality: AMFm (30 mins) ……..……Julian Schweitzer, The World Bank

The Catalyst: Roll Back Malaria Partnership (15 mins) ……..……..Message from: Awa Marie Coll-Seck, Roll Back Malaria Partnership

10:40 – 12:00 noon
Session 2: Support for AMFm

One view from the malaria-endemic world (20 mins)……..Eyitayo Lambo, Former Minister of Health, Nigeria

Another view of AMFm from Africa (10 mins) ……..Naawa Sipilanyambe, UNICEF

The Global Fund: Possible implementer of AMFm (20 mins)……Jean-Paul Moatti, The Global Fund

A donor perspective on AMFm (15 mins)……..……..…… Delna Ghandhi, Department for International Development, UK

Discussion (15 mins)

12:00 – 1:00 pm Lunch

1:00 – 4:00 pm
Session 3: The World With and Without AMFm: Issues to Consider

Resistance to malaria drugs (25 mins)..……..……Christopher V. Plowe, Howard Hughes Medical Institute

Artemisinin use by pregnant women (25 mins)……..……Nicholas J. White, Mahidol-Oxford Tropical Medicine Research Unit

Use of diagnostic technologies for malaria (25 mins)..……..……Christopher Whitty, London School of Hygiene & Tropical Medicine

Pilot experiences to inform AMFm (25 mins)..……..……..Oliver Sabot, Clinton Foundation

Reaching the poorest of the poor with effective malaria drugs (25mins)..……..Ricardo Bitrán, Bitrán and Associates

Discussion (40 mins)

3:45 – 4:00 Wrap-up — Barry Bloom, Harvard School of Public Health