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Is Affordability and Accessibility All It Takes?

A Case Study on the Affordable Medicines Facility – Malaria in Malaria Endemic Countries

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Abstract

The Affordable Medicine Facility – malaria (AMFm) was a pilot project established to subsidize quality-assured artemisinin-based combination therapies (QAACTs) in eight malaria-endemic African regions: Kenya, Uganda, Ghana, Niger, Nigeria, Madagascar, Tanzania (mainland) and Zanzibar. The objectives of the program were to increase the affordability and availability of artemisimin-based combination therapies (ACT), as well as the market share relative to other less effective antimalarial medicines. Overall, the AMFm program had a greater impact in the private-for-profit sector than the public sector. In general, public services do not work as well as their private counterparts in most countries. Inadequate services in remote areas necessitate prohibitively long journeys to access resources and care. In general, the private sector was able to provide supplies of ACTs, as long as it was profitable. Seven countries showed significant increases in availability in the private sector, six regions had significant decreases in QAACT cost, with declines ranging from $1.28 to $4.82, and all eight regions had increases in market share. Impact in remote regions was substantial, with 60% (Ghana) and 48.5% (Kenya) of facilities in remote areas stocking QAACTs. Negotiations with manufacturers, the involvement of the private sector, and supporting interventions were critical in the success of AMFm. The AMFm pilot project then transitioned into a private sector co-payment mechanism involving only six countries. The AMFm program was not sustainable due to the enormous costs of the program, potentially due to unnecessary and excessive orders of ACTs, with an estimated total of 500 million USD. Fixing this sustainability issue would make a program such as this one more applicable to other malaria-endemic countries, which have limited financial resources.

Key Words Affordable medicine facility malaria, global health, drug accessibility, Global Fund

INTRODUCTION

Malaria is a life-threatening disease caused by *Plasmodium* parasites, which is transmitted through the bite of infected female *Anopheles* mosquitoes.[1] Out of the five *Plasmodium* parasite species known to cause malaria in humans (*Plasmodium falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi*), *P. falciparum* and *P. vivax* are the two species which pose the greatest threat.[1] The African region is disproportionately affected by higher rates of malaria. According to the World Malaria Report 2016, there were 212 million new malaria cases worldwide in 2015, with Africa accounting for 90% of cases.

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There were an estimated 429,000 deaths, of which 92% occurred in Africa, predominantly affecting children under the age of five. The main methods for reducing malaria transmission are antimalarial drugs, insecticide-treated mosquito nets and indoor residual sprays.[1]

Quinine was one of the first drugs used to treat uncomplicated malaria. Uncomplicated malaria is the classical presentation of the disease, with "malaria attacks" occurring every few days, consisting of mild symptoms such as fever, headaches, vomiting, etc. This contrasts severe malaria, which has complications including multi-organ failure.[2] Its synthetic derivatives, chloroquine and primaquine, are still used today in many countries as monotherapies (i.e. a single antimalarial pharmaceutical drug used on its own, not in combination with any other antimalarial drug).[3,4] Antifolates are other drugs that target enzymes in the folate metabolism pathways of the parasites, thereby inhibiting the parasite's ability to perform methylation reactions, essential for its survival.[3] The *Plasmodium* parasites have become increasingly resistant to these widely used drugs, due to spontaneous mutations that occur in the parasitic gene coding for the drug target. For this reason, the World Health Organization (WHO) recommends artemisinin-based combination therapies (ACTs), the most effective treatment for uncomplicated malaria as they include multiple pharmaceutical drugs taken in combination. This reduces the likelihood of the malaria parasite developing resistance, since the use of multiple drugs with different parasitic targets significantly reduces the probability of the parasite developing spontaneous resistant mutations in all of these drug targets, compared to the chance of developing a single mutation to resist a monotherapy.[5] The majority of malarial deaths occur in children under five years of age, and ACTs are estimated to reduce mortality in children aged 1-2 years by 99% (94-100%) and by 97% (86-99%) in children aged 2-5 years.[6]

There have been many challenges in ensuring ACT usage and adherence. These include inappropriate drug use, an imbalance in the demand and supply of certain drugs, and the lack of affordability in the poorest countries.[7] By 2006, 34 countries in sub-Saharan Africa adopted the WHO's recommendation of using ACTs as first-line treatment for uncomplicated malaria.[8] Of the 34 countries, 10 could deploy ACT drugs through the public sector, while the majority of infected individuals continued to be treated with ineffective drugs/monotherapies.[8] The average cost of ACTs in 2004 was 2.40 USD per course of treatment for an adult, a stark increase in price from the previous standard drug chloroquine, which costs about 0.10 USD per course of treatment Furthermore, ACTs are subjected to a monopoly mark-up of up to five times in African private sector pharmacies, thereby making it nearly impossible for the poorest to afford.[9]

The Affordable Medicine Facility – malaria (AMFm) was an innovative program based on a 2004 study by the US Institute of Medicine titled, *Saving Lives, Buying Time: Economics of malaria drugs in an age of resistance*. The study concluded that an effective solution to malaria treatment was the distribution of subsidized ACTs. This strategy would achieve two goals: reducing malarial mortality by improving affordability and access to ACTs, as well as delaying the development of drug resistance using this combination therapy.[10] AMFm was carried out by the Global Fund to Fight AIDS, TB and Malaria (Global Fund). The Global Fund was previously subsidizing pharmaceutical drugs in the public sector. However, a large proportion of the population in Africa relies on the private sector for their medications, since they often provide higher-quality services, or services not otherwise available in the public sector. Hence, the private sector was targeted in this pilot program to reach more people. The objectives of the program were to 1) increase ACT affordability; 2) increase ACT availability; 3) increase the market share of ACTs relative to oral artemisinin-based monotherapies and other less effective antimalarial medicines; and 4) increase ACT use.[11] The project's financing mechanism involved 1) reducing the price of quality-assured ACTs (QAACTs) directly with manufacturers, 2) subsidizing buyers via a co-payment to manufacturers for the purchases made by public, private and non-governmental organizations, and 3) promoting the use of appropriate anti-malarial drugs through interventions such as awareness campaigns.[12] In 2010, a pilot phase of the AMFm was implemented in eight regions: Kenya, Uganda, Ghana, Niger, Nigeria, Madagascar, Tanzania (mainland) and Zanzibar (Figure 1). From August 2010 to December 2011, an estimated 115.8 million QAACT doses were deployed to participating countries through AMFm's actions.

This case study focuses on whether a financing mechanism funding ACTs was able to increase the uptake of these antimalarial drugs in countries that have been disproportionately affected by malaria.

We analyze how these life-saving treatments were made affordable to vulnerable populations and whether such a financing mechanism is sustainable in the long run.

STRATEGY

The AMFm received support from multiple organizations, such as the Bill and Melinda Gates Foundation, the Department for International Development (DfID) and UNITAID, and cumulatively raised approximately 500 million USD to carry out the aims of this financing program in the eight pilot regions.

A distinctive feature of the AMFm program was the principle of a single global subsidy aimed to increase treatment with QAACTs in not only the public sector, but also the private for-profit sectors.[13] This was done by AMFm donors who negotiated the ex-manufacturer price which was lowered due to pool procurement with the pharmaceutical companies that established master supply agreements for the AMFm program; Ajanta Pharma, Cipla, Guilin Pharmaceutical, Ipca Laboratories, Novartis and Sanofi-Aventis. These pharmaceutical companies met AMFm's quality criteria for the supply of ACTs to first-line buyers. The master supply agreements required the companies to supply ACTs to first-line buyers in the private sector at the same reduced prices as they sell to public-sector buyers.[14,15] A buyer subsidy through a co-payment at the top of the supply chain aimed to reduce the bargained price of QAACTs by 95%, rendering them cheaper than oral artemisinin-based monotherapies.[16]

The AMFm sought to initiate and fund supporting interventions and demand generation at the country-level that promoted the appropriate use of ACTs. These interventions included public education and awareness campaigns, planning for national policy and regulations, training and monitoring ACT providers and health workers, pharmacovigilance, expanded use of diagnostics, operational research and additional activities that focused on delivering QAACTs to the poorest populations and those living in remote locations.[16]

The WHO supervised the manufacturing of subsidized QAACTs through the WHO Prequalification Programme which assured the safety, quality and efficacy of these products.[17] They branded the packaging with a distinguishable Green Leaf Logo so that the population could recognize approved QAACTs, driving out the use of less effective medicines.[18] Moreover, arrangements were made with the manufacturers such that they would not market oral artemisinin monotherapies.[14]

The independent evaluation of the AMFm pilot project was to weigh if, and to what extent, the AMFm Phase 1 objectives, consisting of the six benchmarks of success outlined below, were reached in the pilot countries. It was performed by the London School of Hygiene and Tropical Medicine by an Independent Evaluation Team. Each country was treated independently as a case study and the evaluation was based on a pre- and post-test intervention assessment.[16] The results were compared to the AMFm benchmarks of success and interpreted in the context of specific countries (Table 1).

TABLE I.

Benchmarks	Description
#1	Achieve an overall increase of 20% in QAACT availability (public and private sectors combined)
#2	Median overall price of QAACTs with AMFm logo is less than 3 times the median price of most popular antimalarial in the region
#3	Median overall price of QAACTs with AMFm logo is less than median price of artemisinin monotherapy tablets on the market
#4	5% increase in children with fever who received ACT treatment
#5	Increase overall market share of QAACTs by 10% in each pilot region
#6	Significant decrease in overall market share of oral artemisinin monotherapy

a. AMFm benchmarks of success and their description. Metrics were based on thresholds proposed for one year after the effective start date of AMFm at the country level.

IMPACT

QAACTs Availability

The AMFm program had a much greater impact on the availability of QAACTs in the private-for-profit sector. AMFm led to significant increases in availability in the public sector in four of the eight pilot regions, with the biggest increase in Niger (28.1%).[5] Uganda, Tanzania, Nigeria and Ghana did not show significant increases in availability in this sector. To contrast, seven of eight pilot regions showed significant increases in QAACT availability in the private-for-profit sector.[5]

Madagascar was the only region to not show any statistically significant increase in QAACT availability. Benchmark 1 was attained in Ghana (52%), Kenya (35%), Tanzania (44%), Uganda (46%) and Zanzibar (39%). This benchmark may have also been reached in Nigeria (26%), however the statistical evidence is not as convincing (i) (see Figure 2).[5]

Cost Reduction

All public sectors in the pilot regions, apart from Ghana, offered QAACTs free of charge before the AMFm program. However, this does not reflect other fees that were likely added. The median price of one adult dose of QAACTs in the public sector in Ghana before AMFm was $2.74, which fell to $0.94. The price of QAACTs in the private sector were costlier in all regions except Madagascar, which already had a national subsidy program that reduced the cost of the drugs to $0.14 before the AMFm program began. The median cost of QAACTs in Madagascar increased to $0.60 following AMFm. Conversely, six of the eight pilot regions had significant decreases in QAACT cost following the implementation of AMFm, with declines ranging from $1.28 (Niger) to $4.82 (Zanzibar) (see Appendix I).[5]

Benchmark 2, which was achieving a median overall price of QAACTs with AMFm logo being less than 3 times the median price of most popular antimalarial in the region, was achieved in Kenya, Madagascar, Niger, Tanzania and Zanzibar (see Table 2a). Benchmark 3, achieving median overall price of QAACTs with AMFm logo being less than the median price of artemisinin monotherapy tablets on the market, was achieved in Ghana, Nigeria and Zanzibar (see Table 2b). Data was not collected on the median price of oral artemisinin monotherapies in the other five regions.[5]

Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation "Fig. 1", even at the beginning of a sentence.

TABLE IIa.

	Median price of AMFm co-paid QAACT at endpoint	**Median price of the most popular non-QAACT anti-malarial at endpoint**	**Ratio of price of QAACT to most popular antimalarial (95% CI)**	**Test for achievement of benchmark 2 (p value)**	**Achievement of benchmark 2**
Ghana	0.94	0.31	3.0 (2.9 to 3.2)	0.8127	No
Kenya	0.52	0.52	1.0 (0.6 to 1.5)	<0.0001	Yes
Madagascar	0.51	0.32	1.6 (1.6 to 1.6)	<0.0001	Yes
Niger	1.19	0.48	2.5 (2.2 to 2.8)	<0.0001	Yes
Nigeria	1.48	0.47	3.1 (3.1 to 3.2)	0.9998	No
Tanzania	0.94	0.94	1.0 (1.0 to 1.0)	<0.0001	Yes

Uganda	1.96	0.59	3.3 (3.3 to 3.3)	0.9999	No
Zanzibar	1.17	0.79	1.5	—	Yes

Evaluation of attainment of benchmark 2 per pilot region. No CIs shown for Zanzibar, since a complete census of outlets was done.[5]

TABLE IIb.

	Median price of AMFm QAACT at endpoint	**Median price of oral artemisinin monotherapies**	**Difference in price of QAACT and oral artemisinin monotherapies (95% CI)**	**Test for achievement of benchmark 3 (p value)**	**Achievement of benchmark 3**
Ghana	0.94	1.88	-0.94 (-0.95 to -0.93)	<0.0001	Yes
Nigeria	1.48	2.66	-1.17 (-1.24 to -1.10)	<0.0001	Yes
Zanzibar	1.17	7.46	-6.30	—	Yes

Evaluation of attainment of benchmark 3 per pilot region tested. No CIs shown for Zanzibar, since a complete census of outlets was done.[5]

QAACTs Market Share

Market share increased in four of the pilot countries in public health facilities, including Ghana, Nigeria, Uganda and Zanzibar. The market share of QAACTs was increased in all eight regions in the private sector.[5]

Four of the pilot regions reached benchmark 5, which was an increase in overall market share of QAACTs by 10%. Uganda and Tanzania also showed over a 10% increase in market share of QAACTs, however the statistical evidence of this data is weaker. Madagascar and Niger did not show a statistically significant increase in market share (see Figure 3). Benchmark 6 was only tested in Nigeria and Zanzibar, as the other six pilot regions had very low amounts of monotherapies available before the beginning of AMFm. However, both Nigeria and Zanzibar met the goal, decreasing the overall availability of monotherapies by 3.9% and 12% respectively (see Table 3).

TABLE III.

	Overall decrease in market share of oral artemisinin monotherapies (95% CI)	**Test for achievement of benchmark (p value)**	**Attainment of benchmark 6**
Nigeria	-3.9 (-7.9 to 0.0)	0.0258	Yes
Zanzibar	-12.0	—	Yes

Evaluation of attainment of benchmark 6 per pilot region tested. No CIs shown for Zanzibar, since a complete census of outlets was done.[5]

Comparison to Non-Pilot Regions

Two African countries that could have been potential comparators were Zambia and Benin. These countries had baseline and endpoint data collected on QAACT availability, cost and market share at approximately the same time points as those previously presented. These countries have different contextual aspects which may present as confounding factors. For example, the private sector in Zambia plays a smaller role in the distribution of antimalarial medication, compared to those countries included in the AMFm pilot.[5] Although they should not be used as exact controls, it is still useful to compare the data on QAACT from these countries to those which were under the AMFm program, to further assess the impact of AMFm. Over a similar time period as the AMFm project, there were no significant changes in price or availability of QAACTs in the public health sectors of Zambia or Benin. However, there were significant increases of over 10% in QAACT market share in both of these countries in the public sector, similar to what was seen in 5 of the pilot regions. Also, the cost of QAACTs in the private sector decreased in both countries but still remained higher than the endpoint cost of QAACTs in the private sectors of all pilot regions.[5]

There is also weak evidence of QAACTs already becoming more available and accessible to populations in some malaria endemic regions before the implementation of AMFm. This data was only available for Uganda and Madagascar, which showed a 2-3 percentage point increase in the use of QAACTs between 2008-2010.[5] Since there already seemed to be a slight upward trend toward the use of QAACTs, combined with the significant market share improvements of QAACTs in non-AMFm countries over the same time period as the intervention, there is a possibility that the AMFm did not have as large of an impact as the data suggests. The impact seen from the AMFm program may not be solely due to the program itself, and it is possible that the countries were already starting to improve the distribution of QAACTs before the intervention even began. Nevertheless, when compared to Zambia and Benin, it is clear that the AMFm program did lead to significant improvements in terms of QAACT availability, price and market share.[5]

Impact in Remote Regions

To assess whether the program impacted remote regions in these countries, 149 remote areas in Ghana and 396 in Kenya were compared against 487 non-remote areas in Ghana and 1223 in Kenya.[20] In Ghana, 60% of facilities in remote areas had QAACTs with the AMFm "Green Leaf" logo available, compared to 81.5% in non-remote areas. Similarly, 48.5% of facilities in remote areas in Kenya had QAACTs available, compared to 64% in non-remote areas. Although these are significant differences, QAACTs were still made widely available in remote areas, showing that the AMFm program had a substantial impact in these hard-to-access regions. There were no differences in overall cost between remote and non-remote areas in either country. Similarly, the market share of QAACTs in Ghana had no significant differences between remote and non-remote areas. However, remote areas in Kenya still had a majority of non-artemisinin therapy on the market (50.1%) (see Table 4).[20]

TABLE IV.

		Availability		**Cost**		**Market Share**
		Availability of QAACTs with AMFm logo (95% CI)	**p value**	**Median cost of one adult dose of QAACTs**	**p value**	**Market share of QAACTs**
Ghana	**Remote areas**	60.4 (37.7 to 79.3)	<0.0001	1.00 (0.94 to 1.88)	0.1121	56.8
	Non-remote areas	81.5 (76.7 to 85.6)		0.94 (0.94 to 1.88)		54.1

Kenya	**Remote areas**	48.5 (36.2 to 61.0)	<0.0001	0.46 (0.00 to 1.15)	0.2423	37.6
	Non-remote areas	64.0 (56.3 to 71.0)		0.46 (0.46 to 0.69)		53.2

Comparison of AMFm impact on remote vs. non-remote areas, in terms of availability, cost reduction and market share, in Ghana and Kenya.[20]

Private Sector Co-Payment Mechanism

The private sector co-payment mechanism (CPM) was put into place in six countries following the AMFm pilot phase. Surveys were done from 2011 until 2015 in 139,738 different outlets across five of these countries (Madagascar, Uganda, Tanzania, Nigeria and Kenya) to assess if the impact was maintained following the AMFm program.[20] Madagascar showed a significant increase in QAACT availability of 19% two years post-AMFm in 2013. However, by 2015, the availability of QAACTs decreased to levels similar to pre-AMFm. During the CPM phase, Nigeria had the most significant increase of availability in the private sector of 30%. Tanzania is the only region which maintained the same median costs from the end of AMFm until 2014. Madagascar was the only region which showed increases in QAACT cost during AMFm, but significant decreases in cost were seen following the end of AMFm until 2013, however the prices once again rose between 2013 to 2015.[20]

Nigeria is the only country which had significant increases in QAACT market share from 2009 until 2015. Madagascar showed increases in QAACT market share throughout the AMFm program and slightly thereafter, from 2010 until 2013, but sharp declines were seen from 2013 until 2015. Similarly, Kenya's QAACT market share significantly increased from 2010 until 2011, but then once again declined when surveyed in 2014. Based on the last survey taken in each region, QAACTs represented the majority of antimalarials on the market in Uganda and Kenya (48% in each). Non-artemisinin therapies remain the most common antimalarials found on the market in the majority of these countries.[20]

Unfortunately, there is no published data collected thus far on actual health outcomes, which is the ultimate goal of this financing program.

FINANCING

AMFm heavily depended on funding from several different actors to remain operational. The funding was geared toward improving the weaknesses of the existing supply chains in both public and private sectors.[16] The financing of the AMFm Phase 1 pilot was separated into two different sections and cost an estimated total of 500 million USD.[21]

The first branch of funding was directed to subsidizing the first-line buyers of ACT at the top of the global supply chain through a co-payment fund.[16] AMFm donors negotiated an ex-manufacturer price, which was decreased through pool procurement with the pharmaceutical companies that were the master suppliers for the AMFm program. This enabled the public and private purchasers to pay a smaller amount to wholesalers for the treatment. At the beginning of the AMFm Phase 1 between July 2010 to February 2012, a total of 216 million USD was contributed.[16] The actors that initially funded the program were the Bill and Melinda Gates Foundation, the Department for International Development (DfID), and UNITAID. AMFm was replenished from March 2012 to December 2012, partly due to delay in launching the program, an increase in projected demand, and a co-payment price that was higher than expected.[22] An additional 120 million USD was funded from the DfID, UNITAID, and the Canadian International Development Agency (CIDA).[16] In total, 336 million USD financed the subsidy for ACTs in Phase 1 of AMFm.

The second component of funding of AMFm was for the support of interventions that ensured proper use and scale-up of ACT drugs to guarantee that the project was working all the way from global supply

chain level down to the patient level. The Global Fund funded the total amount, 127 million USD, for the supporting interventions.[16]

AMFm was established by the Global Fund, although this mechanism has ended, the organization will continue investing in the prevention and treatment of malaria.

REASONS FOR SUCCESS

AMFm was successful because it subsidized QAACTs, which are more effective therapies.[16] The CPM aimed to make ACTs as affordable as the ineffective treatments. This was made possible through price negotiations with manufacturers. The main objective of these negotiations was to reduce the manufacturer prices of ACTs for private sector importers to the same level as public sector buyers.[16] In exchange for the larger volumes of ACTs, AMFm demanded manufactures to reduce prices. The lower per dose costs would result in a greater market share, availability and use of QAACTs in both public and private sectors.

Another success of AMFm was that it involved both the public, and more importantly, the private-for-profit sector which acts as the primary pharmaceutical vendor for many. Before AMFm, the public sector had a higher proportion of ACTs that were free or highly subsidized compared to the private-for-profit sector.[16] Despite this, in pilot countries, 40-97% of antimalarial sales volume occurred in the private sector, where the access and use of ACTs was still low due to high retail prices.[16] Through the AMFm there were large changes in the availability, price, and market share of ACTs within a few months. The AMFm did not change individual countries' delivery system. However, because the majority of individuals sought antimalarial treatment through the private sector, making ACTs more affordable and accessible within this sector by utilizing the distributional capacity of the private sector and bypassing the procurement and granting issues of the public sector is another of its successes.

Lastly, the incorporation of supporting interventions was critical in the success of the AMFm as it played a crucial role in providing awareness of the program. Key components of these supporting interventions focused on communication campaigns (a national launch, advertisements on TV and radio, posters, billboards, etc.), community-based activities, and training of anti-malarial providers.[23] Amongst private-for-profit providers, pilot countries with higher achievement had a longer period of co-paid ACTs with the simultaneous implementation of supporting interventions in common.[16] For example, countries that had longer communication campaigns of 5-9 months, reported a greater awareness of the AMFm 'green leaf' logo, the ACT subsidy program, and the recommended retail price. The interventions supported the implementation of the program and promoted appropriate antimalarial use.[23]

LIMITATIONS: MADAGASCAR AND NIGER

Madagascar and Niger were less successful in meeting the AMFm benchmarks and experienced much lower orders of ACTs compared to other countries.[16] This is due to the differences in the structure of their private-for-profit sector, supporting interventions not being delivered and generally unfavourable political and economics contexts.

In both Madagascar and Niger, the private-for-profit antimalarial market was dominated by less formal providers such as general and itinerant vendors that were not allowed to stock QAACTs due to government regulation.[16] Informal vendors dominating the private-for-profit sectors in both Madagascar and Niger resulted in QAACTs being largely inaccessible.

Further, both countries failed to implement supporting interventions. However, this was not due to AMFm itself. A full-scale media campaign was not possible in Madagascar due to laws prohibiting the advertising of prescription medications.[16] Niger experienced an 8-month delay between the time that first-line buyers placed orders for co-paid ACTs and the time that they arrived. This delay limited grant activity, aroused suspicion, and resulted in the Global Fund investigating Niger for corruption allegations and resulted in them never being able to fully adopt their public awareness and marketing campaigns.[16]

Lastly, there were unfavorable political and economic contexts in both countries. The intervention followed Madagascar's 2009 coup and there was extreme weather in Niger that caused drought, flooding and food shortages.[16] It is unclear whether a successful implementation of supporting interventions would have improved the outcomes of the AMFm in both countries given their political and economic hardships.

Madagascar and Niger's limitations further highlight the importance of the involvement of the private-for-profit sector, the implementation of supporting interventions, and stable political and economic contexts as key components of AMFm's success.

FUTURE IMPLICATIONS

Once Phase 1 of AMFm ended, there was a transition to a private sector CPM. Unlike Phase 1, CPM was completely funded by the Global Fund and it focused solely on the private sector, which was more successful in the AMFm pilot. The CPM operated using three elements from the AMFm: price negotiations with manufacturers, ACT subsidies, and additional supporting interventions.[20] The CPM is presently still in place; however, only in a few countries and it is under tighter regulations. Not every first-line buyer is eligible to receive the subsidy. One noticeable difference is that it is no longer a market-based mechanism, such that, a direct increase in market share is no longer a top priority. It still follows a co-payment and the subsidy program still exists to lower the price of drugs.[15] However, a greater focus must be placed on non-market-based approaches, where supporting interventions (previously aforementioned) need to continuously be implemented to address the issue of non-artemisinin therapies, which in turn will create a higher demand for QAACTs.[20] As a result, these non-market-based approaches will positively influence the QAACT market indirectly.

In conclusion, although the AMFm program did show success in 5 of the 8 pilot countries for availability and price of QAACTs, and 4 pilot countries showed success in QAACT market share benchmarks, the AMFm program would not have been sustainable long-term due to higher than expected costs. The funds for this program for was running out for, and there was an inability to prolong the copayment plan going forward. One of the potential reasons for the increase in this cost is that there were often excessive orders of ACTs, which were not based on the clinical needs of the country.[10] With the lack of funds, they were unable to fulfill the demands of these countries and were forced to supply fewer doses to certain countries.[16] A potential solution to this problem, and one that the global health leaders could learn from, would be to implement rapid diagnostic tests (RDTs) simultaneously in order to control prescription practices, by prescribing treatments to individuals who actually have malaria. As was seen during the pilot program, many people were taking these drugs without being infected with the parasite, further increasing resistance.[16] This not only wasted the money allocated for this program, but also contributed to accelerating resistance to artemisinin, complicated the estimates of malaria burden as well as the progress of these interventions, and delayed the appropriate treatment for the true cause of the illnesses. By implementing RDTs concurrently with the program would control the overuse of QAACTs as a result of over-diagnosis. Likewise, orders of ACTs would not be as excessive and perhaps this would render the program more sustainable long-term. Furthermore, malaria is a disease that mainly affects children, however, most of the subsidized doses were adult doses instead of pediatric ones. Pediatric doses are generally cheaper than adult doses, therefore giving the correct doses would be more cost-effective.[16] Moreover, the United States (one of the largest aid donors) did not donate to the AMFm. They did not find compelling evidence to support the efficacy of the program, therefore were not obliged to donate.[24] Additionally, it was difficult for most of these countries to scale their supporting interventions, but if they had more time, this issue could have potentially been resolved.[10] Pilots with earlier start dates achieved more benchmark successes, especially if the combined presence of co-paid ACTs and large scale educational and behavioral communications are considered a proxy for the full AMFm implementation, thus a longer duration of implementation seems to be positively correlated with performance. Although, it should be noted that delayed start dates can be because of a lack of capacity to implement the program in the first place, therefore caution should be taken when attributing success to duration of implementation.[16]

Lastly, a next step that can be taken would be to expand a program such as this one and resolve the weaknesses that it had. This program was supposed to expand after the first phase, which proved to be

somewhat successful in lowering the costs of QAACTs. However, after the shift to CPM, the number of countries with the implementation actually decreased from eight to six.[20] Including more countries that are affected by malaria would be beneficial and reduce the number of deaths caused by this life-threatening disease.

APPENDIX

	Median cost of one adult dose of QAACTs					
	Public sector (baseline)	**Public sector (endpoint)**	**Change**	**Private sector (baseline)**	**Private sector (endpoint)**	**Change**
Ghana	2.74	0.94	-1.8	3.42	1.13	-2
Kenya	0	0	0	2.63	0.58	-2
Madagascar	0	0	0	0.14	0.6	0
Niger	0	0	0	4.47	1.48	-3
Nigeria	0	0	0	4.47	1.48	-3
Tanzania	0	0	0	5.28	0.94	-4
Uganda	0	0	0	2.79	1.96	-1
Zanzibar	0	0	0	5.99	1.17	-5

Overall decrease in price of QAACTs, in the public and private sectors combined.[4]

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FIGURES

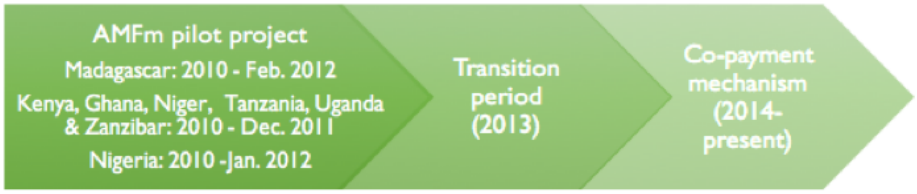

Figure 1. AMFm timeline. The AMFm pilot project began in 2010, and ended at slightly different times in the different regions. The transition period followed, until 2013, followed by the CPM from 2014 until the present.

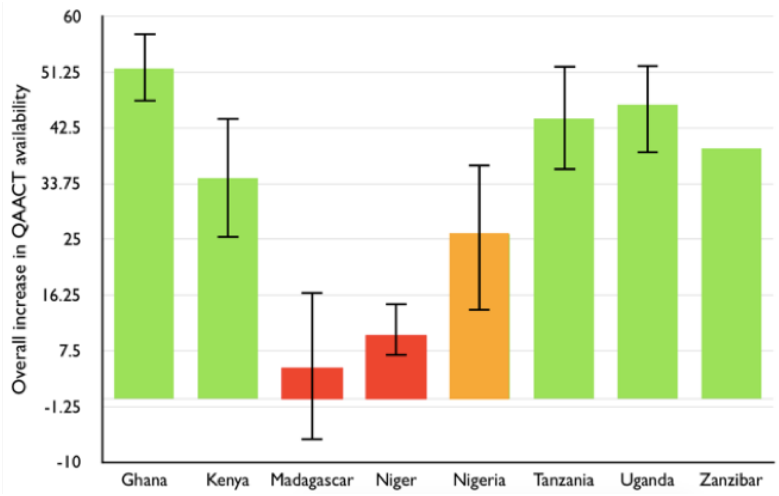

Figure 2. Overall increase in availability of QAACTs, in the public and private sectors combined. Evaluation of attainment of benchmark 1 per pilot region: green = met benchmark, orange = may have met benchmark, red = did not meet benchmark. No confidence intervals (CIs) shown for Zanzibar, since a complete census of outlets was done. [5]

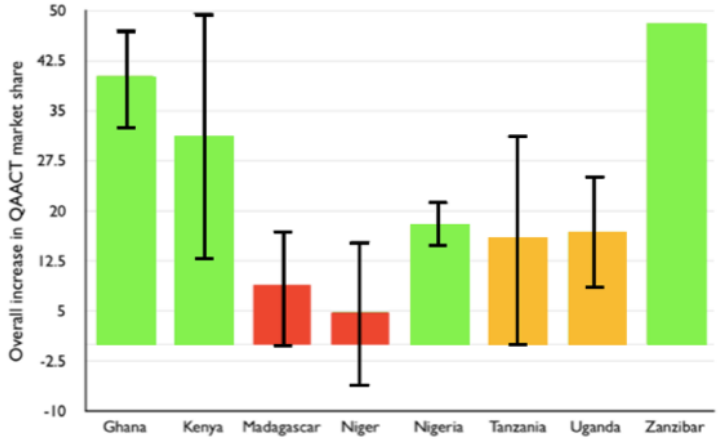

Figure 3. Overall increase in market share of QAACTs. Evaluation of attainment of benchmark 5 per pilot region: green = met benchmark, orange = may have met benchmark, red = did not meet benchmark. No CIs shown for Zanzibar, since a complete census of outlets was done.[5]

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