Global Malaria Diagnostic and Artemisinin Treatment Commodities Demand Forecast

2015 – 2019 Forecast

March 4, 2016

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UCSF University of California San Francisco

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List of Abbreviations

ACT(s) – Artemisinin Combination Therapy/Therapies

ACTwatch – Artemisinin Combination Therapy watch

AMFm – Affordable Medicines Facility for malaria

AL – Artemether Lumefantrine

API – Active Pharmaceutical Ingredient

ASAQ – Artesunate Amodiaquine

BCG – Boston Consulting Group

CHAI – Clinton Health Access Initiative

CPM – Co-Payment Mechanism (formerly Private Sector Co-Payment Mechanism)

DHA-PQP – Dihydroartemisinin piperaquine phosphate

DHS – Domestic Household Survey

GFATM – Global Fund to fight AIDS, Tuberculosis, and Malaria

IRS – Indoor Residual Spraying

ITN(s) – Insecticide Treated Net(s)

MICS – Multiple Indicator Cluster Survey

MIS – Malaria Indicator Survey

MIT – Massachusetts Institute of Technology

MOPs – Malaria Operational Plans

NMCP (s) – National Malaria Control Program(s)

PMI – The President's Malaria Initiative

PSCM – Private Sector Co-payment Mechanism (see CPM)

QAACT(s) – Quality Assured Artemisinin Combination Therapy/Therapies

QARDT(s) – Quality Assured malaria Rapid Diagnostic Test(s) [defined by the WHO procurement criteria for RDTs]

RBM – Roll Back Malaria Partnership

RDT(s) – (malaria) Rapid Diagnostic Test/Tests

UCSF – University of California, San Francisco

WHO/WHO-GMP – World Health Organization/World Health Organization – Global Malaria Program

EXECUTIVE SUMMARY

Recent years have witnessed a dramatic decline in the burden of malaria in endemic countries. The scale-up of effective tools to diagnose and treat malaria has played a significant role in this public health achievement, and continued availability of proven products for malaria case management is essential to sustaining and extending the gains. However, markets for malaria drugs and diagnostics face a number of challenging dynamics that have in the past generated inconsistent product supply, volatile demand, significant price swings, and suboptimal allocation of resources. Given the size of the market for malaria case management commodities and its importance to public health, finding ways to ensure greater stability in the market is critical for broad array of stakeholders including policymakers, market participants – and most importantly – malaria patients.

The Forecasting Consortium for malaria diagnostics and artemisinin treatment commodities was established by UNITAID and a number of global partners to provide better information to policymakers, market participants, and other stakeholders about the size of and trends in the global markets for malaria case management commodities. The forecasting agency comprises the Clinton Health Access Initiative, IMS Health, and University of California San Francisco (UCSF) Global Health Sciences, and reports to a Steering Committee made up of UNITAID and other key global funders and policymakers.

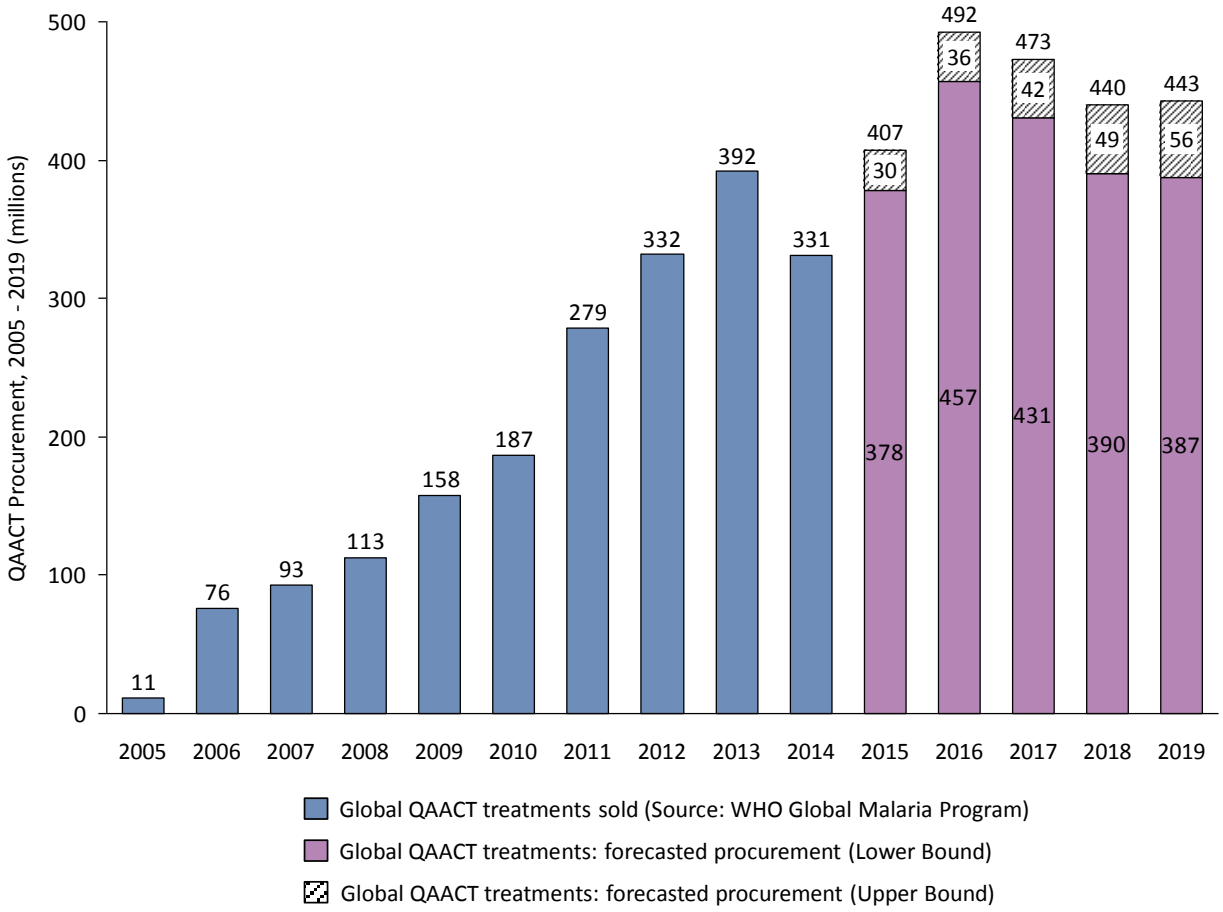
This forecast represents the second in a new series of projections that will be made over the next two years. The forecast presented in this report provides an update to the baseline projection of the size of the malaria commodity market that was presented in the prior published report (INSERT URL) and expands the forecast period from 2015 – 2018 to 2015 – 2019. In addition, this report presents analysis around three events/scenarios that the project steering committee believed might have significant impact on the market for malaria treatment and diagnostic commodities. Future reports will update and extend the baseline forecast, and will also assess different scenarios and events that could impact the market. This forecasting consortium builds on previous models for estimating the size of the market for Artemisinin-Combination Therapies (ACTs), including World Health Organization (WHO)-prequalified ACTs and ACTs that have not met the WHO standards, introduces new information around other categories of drugs, such as injectable artesunate and oral artemisinin monotherapies, and estimates the size of the market for malaria rapid diagnostic tests RDTs.

One key point about nomenclature warrants emphasis. This forecasting report distinguishes three terms that often are used interchangeably but mean very different things: “need”, “demand,” and “procurement”. For this report, “need” represents our projection of the total number of febrile cases where the patient carries malaria parasites

currently detectable by microscopy or rapid diagnostic tests (including cases where the fever may be caused by a separate infection); "demand" represents the number of cases where a consumer would seek treatment for a suspected case of malaria-caused fever (including cases where the fever is not caused by malaria); and "procurement" represents the number of quality assured products that we estimate will be ordered by public or private sector purchasers in the given timeframe. By differentiating these concepts in our terminology we hope to clarify how evolving market dynamics are impacting different decisions around malaria case management.

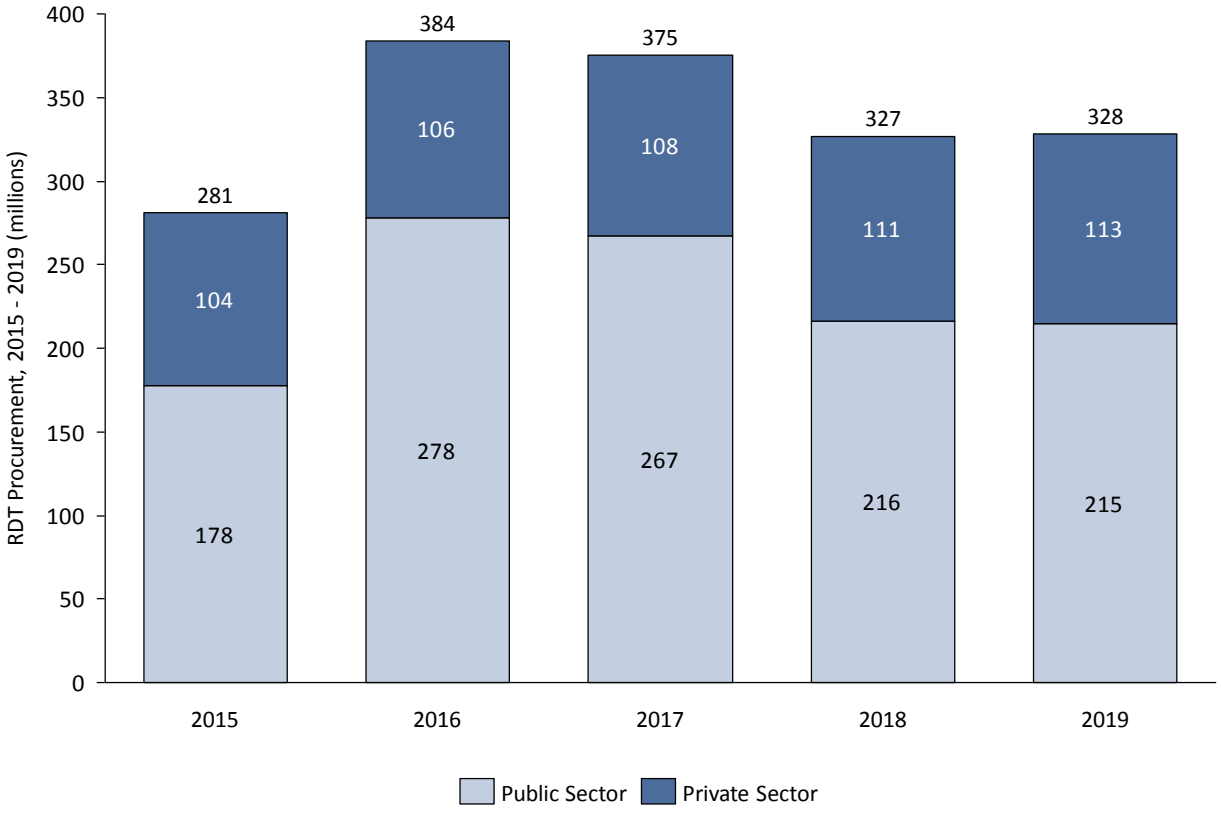
KEY FINDINGS

Procurement



- The global market for Quality-Assured ACTs (QAACTs) is projected to grow from 378M treatments ordered in 2015 to 457M treatments in 2016, due to an increase in public purchases for endemic country malaria programs. Unless there are additional reductions in ACT pricing or more funding is made available, the number of QAACTs ordered will decline slightly to 431M treatments in 2017, 390M treatments in 2018, and 387M treatments in 2019.

- There will be a marked shift in channel mix for QAACTs in this timeframe. Under the Affordable Medicines Facility – malaria (AMFm) pilot program, market participants in eight countries were eligible to obtain subsidized QAACTs for private market resale at a significantly lower price. Starting in 2016, this program will be incorporated into the Global Fund's New Funding Model, and we project that the private subsidized channel will decline from approximately 150M treatments in 2015 to roughly 100M in 2016, and which will hold steady through 2018. This decline in the private subsidized channel will be more than offset by the expansion of public channel orders, which we project will grow from less than 200M treatments in 2015 to approximately 320M in 2016. Since estimates of public channel procurement is based on already committed funding, unless new funding is made available, public channel procurement is expected to decline to 283M in 2017, 236M in 2018, and 226M in 2019.

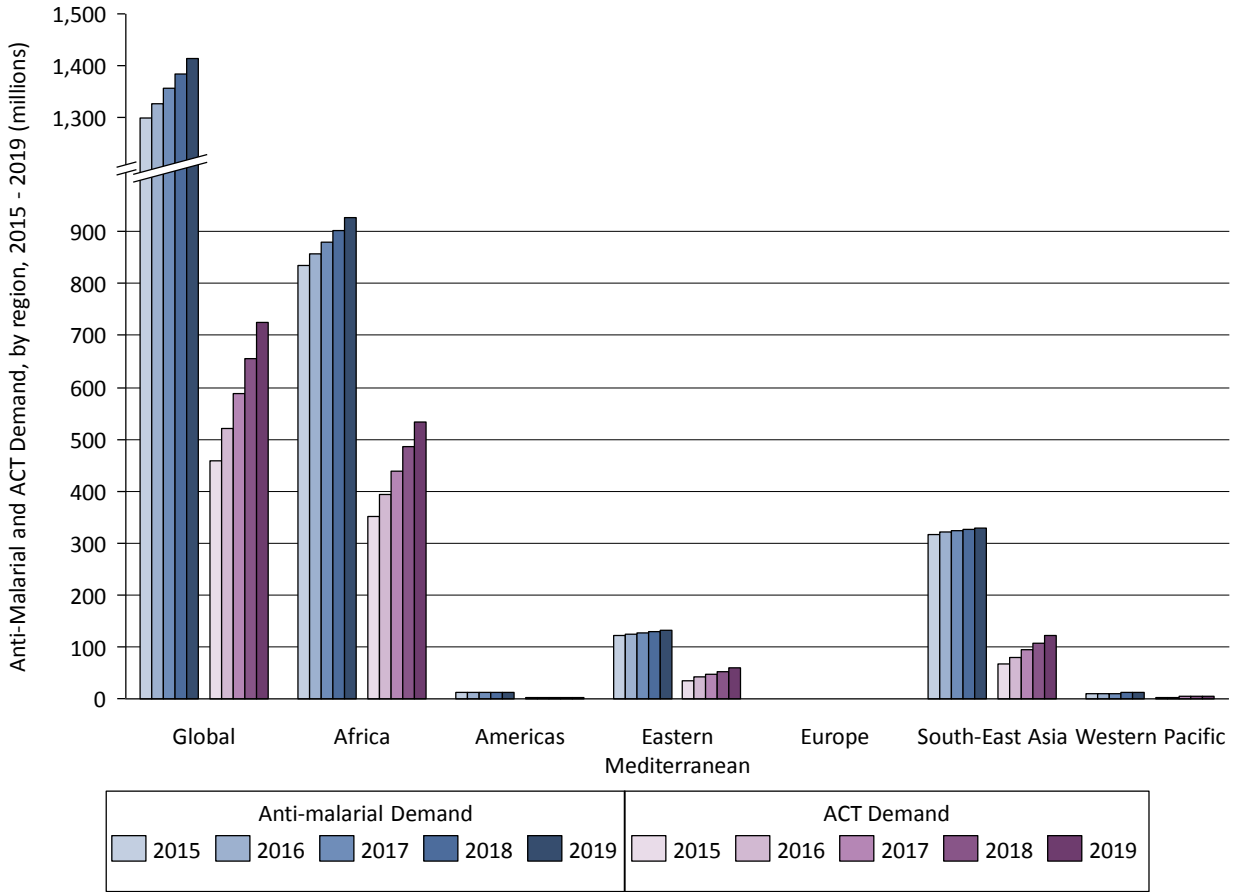


- The share of orders among QAACT drug combinations is unlikely to change significantly during the next three years. In the AMFm pilot, approximately 80% of public funding for ACTs went to countries, most of whom used artemether-lumefantrine (AL) as their mainline therapy. With the application of the Global

Fund's New Funding Model, greater public procurement budgets for other countries will lead to an increase to approximately 150M treatments for artesunate-amodiaquine (ASAQ) in 2016. However, AL will continue to dominate the market for QAACTs through 2019.

- The premium private market for QAACTs is projected to increase over the next few years from 35M treatments in 2015 to 62M treatments in 2019.
- Procurement of RDTs has grown sharply in recent years, and our forecast projects this trend to continue. We estimate global procurement of RDTs at 281M tests in 2015, rising to 384M in 2016. Modeled estimates of RDT procurement, which is based on announced and committed funding, are projected to decline slightly in 2017 and 2018 before stabilizing in 2019 unless additional funding is made available.

Demand



- In 2015, the global market for anti-malarial medicines is estimated to be 1.3B treatment courses per year, and is forecast to grow to over 1.4B treatments by 2019. ACTs currently comprise roughly one third of this market, with their share expanding each year.

- Consumer demand for QAACTs, meaning the number of treatments consumers would seek to obtain and use if they were available, is projected to rise over the timeframe, reflecting population growth in endemic areas and a shift away from other anti-malarial product types. Consumer demand for QAACTs in 2015 is projected to be 349M treatments, rising (assuming continued product availability) to 531M treatments in 2019. The majority of this demand (76%) will be met in the public channel.
- The market for non-quality-assured ACTs (Non-QAACTs) is estimated at 108M treatments in 2015, rising to 194M treatments in 2019. Most of this demand will be in the private channel, with 53 – 55% of non-QAACT treatments will be sold in the informal private channel.
- Among QAACT product combinations, AL will remain the leader, with consumer demand rising from 234M treatments in 2015 to 355M treatments in 2019. ASAQ is projected to remain in second place, with demand growing from 84M treatments in 2015 to 127M in 2019. Demand for Artesunate-SP (ASSP) is expected to increase to 46M treatments in 2019, with India as the main product source.
- Demand for RDTs is expected to grow over this timeframe as well, from 406M tests in 2015 to 448M in 2019. Most of this demand will be met in the public channel, although the private formal and informal channels combine to meet up to a quarter of global demand.
- Artemisinin demand for Active Pharmaceutical Ingredients (APIs) is expected to grow from 197 metric tons in 2015 to 229 metric tons in 2016, and remain flat at 227, 232, and 242 metric tons in 2017, 2018, and 2019, respectively. The increase in artemisinin demand in 2016 is largely driven by a forecasted increase in QAACTs procured in 2016 by 79M. ACTs comprise the majority of global artemisinin demand (96%), with QAACTs accounting for a large share (63-72%) of artemisinin demand.

Need

- Our projections suggest that there were 13.7B fevers in 2015 among-at-risk populations, and that 1.37B fevers occurred in people who were parasitemic. Not all of these fevers, however, were necessarily caused by malaria; some parasitemic individuals may have developed partial immunity to malaria parasites, and their fevers may simply be attributable to another infection.
- The number of fevers in parasitemic individuals is skewed heavily toward Africa. We estimate that approximately 1.1B of the 1.37B total “need” is among African populations, due to the much higher level of parasitemia in that Continent. In contrast, the share of total fevers in malaria-at-risk populations tracks overall population size closely, resulting in a larger share in Southeast Asian countries.
- The estimate of this “need” is expected to rise between 2015 and 2019, largely with population growth. Fevers in parasitemic populations are projected to increase from 1.37B to 1.5B cases over this timeframe. Significant reductions in this measure of “need” will require elimination of malaria from large areas (i.e.,

shrinking the malaria map) and/or the elimination of longstanding subpatent infections among asymptomatic individuals – both of which are longer-term objectives.

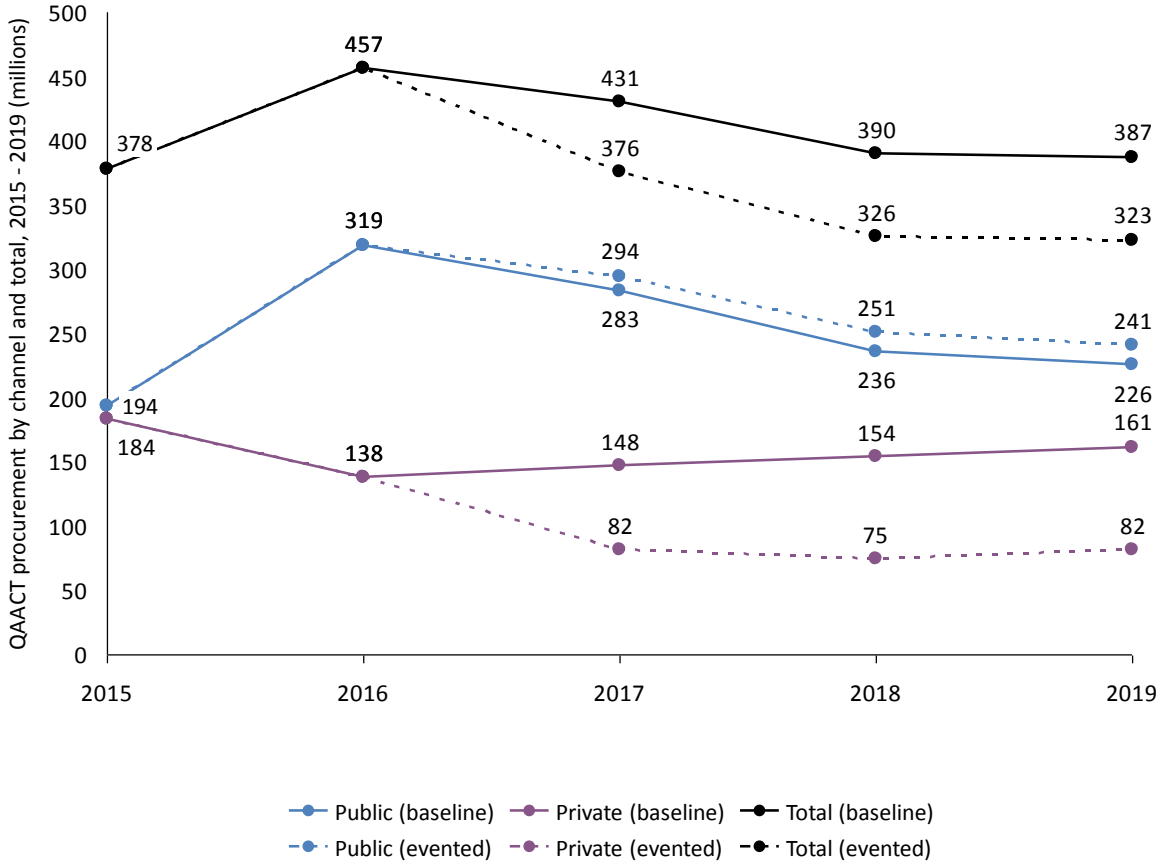
IMPLICATIONS

The markets for malaria diagnostics and treatment commodities are likely to remain very large and important over the near term. Despite shifts in funding models and programs, international funding for QAACT procurement remains very robust. The growth in RDT procurement and use suggests that effective treatments will be allocated in a more appropriate manner than historical patterns of presumptive treatment for malaria have allowed. Moreover, the sharp decline in oral monotherapy treatment suggests progress in the malaria community's efforts to forestall the development and spread of artemisinin-resistant malaria parasites. Continued efforts to sustain support for effective case management commodities promise not only to reduce the burden of disease in the near term but to enable continued progress toward elimination of this disease.

FUTURE SCENARIOS AND PROJECTIONS

In this report, we present analysis around three events/scenarios that could have a significant effect on the markets for ACTs and RDTs. These events are: changes to the funding landscape for (1) ACT or (2) RDT procurement, and (3) the impact that termination of the private sector co-payment mechanism (CPM) would have on ACT demand and QAACT procurement. The recent announcement of a $13B target for the Global Fund to fight AIDS, Tuberculosis, and Malaria's (GFATM) fifth replenishment, and the approval of a $674M FY2016 budget for the US Agency for International Development's President's Malaria Initiative (PMI) in the USA, have dispelled uncertainties in the funding pictures for the first two scenarios.

While the baseline forecast assumes that countries participating in the current CPM will continue to invest in private sector treatment subsidies, the event, which models the effect of a termination of all CPM funding beyond 2016 in Ghana, Kenya, Nigeria, and Uganda, with Tanzania following suit by terminating funding beyond 2017. This hypothetical scenario projects a steep decline in QAACT procurement in 2017 and 2018, as the 2019 QAACT market would reach equilibrium at pre-2012 levels. Most of this decline would be the result of rapid erosion of QAACT sales in the private informal sector once QAACTs no longer held a retail price advantage over non-QAACTs.



Future editions of this forecast report will continue to project the impact of various market events and scenarios on treatment and diagnostic commodity need, demand, and procurement. These "events" will include both supply-side and demand side events with significant potential for market impact. Our hope is that the inclusion of such scenarios will provide policymakers and market participants with a sense of how sensitive our forecasts are to external shocks.

In addition, we will update our prevalence trends to incorporate de-novo shifts in the malaria landscape and epidemiology based on ongoing interventions. We will also leverage new studies or data as applicable to refine our estimates.

I. INTRODUCTION

This is the second in a series of UNITAID reports that forecast ACT need, demand, and procurement, artemisinin monotherapy demand and procurement, RDT demand and procurement, and artemisinin demand. The previous report forecast these outputs for the 2015 – 2018 forecast period, and can be found here: (INSERT URL). This report forecasts these outputs for the 2015 – 2019 forecast period, and defines the outputs as follows:

- ACT Need – The number of treatments that are required to treat all febrile individuals who have a malaria infection at a parasite density that is detectable by diagnostic methods currently used in most settings (microscopy and RDTs), regardless of whether the febrile individual seeks treatment.

- ACT Demand – The number of treatments that are required to meet consumer demand for treatment of suspected malaria with an ACT.

- ACT Procurement – The number of quality-assured treatments that will be procured from manufacturers by public or private sector purchasers.

- Artemisinin Monotherapy Demand – The number of artemisinin monotherapy treatments (including Injectable artesunate) that are required to meet consumer demand for treatment of suspected malaria, or severe malaria.

- Injectable Artesunate Procurement – The number of injectable artesunate treatments that will be procured from manufacturers by public sector purchasers.

- RDT Demand – The number of RDTs that are required to meet the consumer demand for rapid test diagnosis of suspected malaria (e.g., a proxy: the number of patients who sought treatment and received an anti-malarial treatment could be equated to the catchment population for rapid diagnostic testing).

- RDT procurement – The number of RDTs that will be procured by public or private sector purchasers.

- Artemisinin API Demand – Metric tons of artemisinin API required to meet public sector procurement volumes and private sector demand for all artemisinin-based anti-malarial medicines.

This report presents a five-year global baseline forecast (2015 – 2019), for the outputs listed above. For a detailed description of the methods used to generate the forecasts presented in this report, please refer to the document published here: (INSERT URL).

The purpose of this forecast is to provide the global malaria-control community comprehensive insight and information on the scale of global need, demand, and procurement of treatments and diagnostics, to provide information that will inform stakeholders throughout the supply chain for these products, and to provide analysis around the impact of potentially market-shaping events on future demand and procurement of these commodities.

The ACT Forecasting Consortium

This forecasting project is being led by the Clinton Health Access Initiative (CHAI), with partners IMS health, and the University of California, San Francisco (UCSF), providing key analysis and insights. CHAI has an eight-year history of providing accurate and reliable ACT demand forecasts to the global community, and has published peer-reviewed research papers on malaria market forecasting in *Science* and in the *Malaria Journal*. CHAI started forecasting ACT demand in 2007, following substantial fluctuations in the artemisinin market that were the result of premature over-estimates for ACT uptake with the WHO's recommendation of ubiquitous ACT use for uncomplicated malaria. Following the initial market shifts in public sector procurement, the Affordable Medicines Facility, malaria (AMFm), with its aim to expand treatment access in the private sector, induced another period of market uncertainty and coincided with the initial phase of UNITAID's role in supporting global malaria treatment commodity forecasts. As a partner of the UNITAID/RBM ACT Forecasting Consortium, CHAI worked closely with Colin Boyle (formerly of Boston Consulting Group) and Prashant Yadav (William Davidson Institute) on ACT and artemisinin demand forecasts. Colin Boyle, now Deputy Director of Global Health Sciences at UCSF, has worked extensively on malaria-related projects, leading the previous ACT Forecasting Consortium, conducting market forecasting work for Medicines for Malaria Venture (MMV), and the Bill & Melinda Gates Foundation (BMGF), and has helped develop policies that will bolster malaria elimination efforts and build high impact and sustainable investments in health. IMS Health is the world leader in pharmaceutical market research and intelligence, with access to extensive databases of information on the distribution, volume, and price of medicines in markets across the globe, including those in South and Southeast Asia, francophone West Africa, and Latin America. With MMV, IMS has conducted primary market research to assess private sector anti-malarial markets in sub-Saharan Africa

and have built a system to collect information on medicine importation in Zambia, and are currently contracted with UNITAID to build the interface for a repository for market intelligence across the HIV/AIDS, malaria, and TB markets.

II. FORECAST OUTPUTS, 2015 – 2019

ACT Need

Using a decision-tree algorithm, based on febrile incidence extracted from national population-representative household surveys, we have estimated the number of malaria infections among febrile patients across the malaria-endemic world. Our method aims to project the number of febrile individuals who have a malaria infection at a parasite level detectable by diagnostic methods currently used in most settings (microscopy and RDTs), regardless of their treatment-seeking status or whether they fit the case definition. In some settings, without the insight that diagnostic testing can provide, many of these individuals would not necessarily be identified as incident malaria cases as their febrile illness might be primarily caused by concomitant infection (e.g., typhoid).

As reported in our previously published forecast, our model estimates that in 2015, there were around 13.7 billion incident fevers among the malaria-at-risk populations within the 88 countries included in our model. Applying adjusted malaria prevalence to the 2015 fever estimates results in an estimate of 1.37 billion incident fevers with microscopy/RDT-detectable malaria infection. If, in 2015, all such febrile were treated with an ACT (assuming all such events could be identified and treated appropriately), then a total of 1.37 billion ACTs would be required to meet this need (Figure 1). Our current model does not account for the de-novo combined impact of multiple malaria control interventions on prevalence as the data to support such a model is currently unavailable. The model does iterate the effect of increased ACT usage on malaria prevalence (and thus incident fevers), but this effect results in only a slight decline in malaria prevalence throughout the African, American, and South East Asian regions during the five-year forecast period. Thus, with the projected growth in populations-at-risk over this period, our estimates for incident fevers with concomitant microscopy/RDT-detectable malaria infection result in an increasing trend for ACT need. Future iterations of this forecast will incorporate de-novo trends in malaria prevalence as comprehensive data supporting such analysis becomes available.

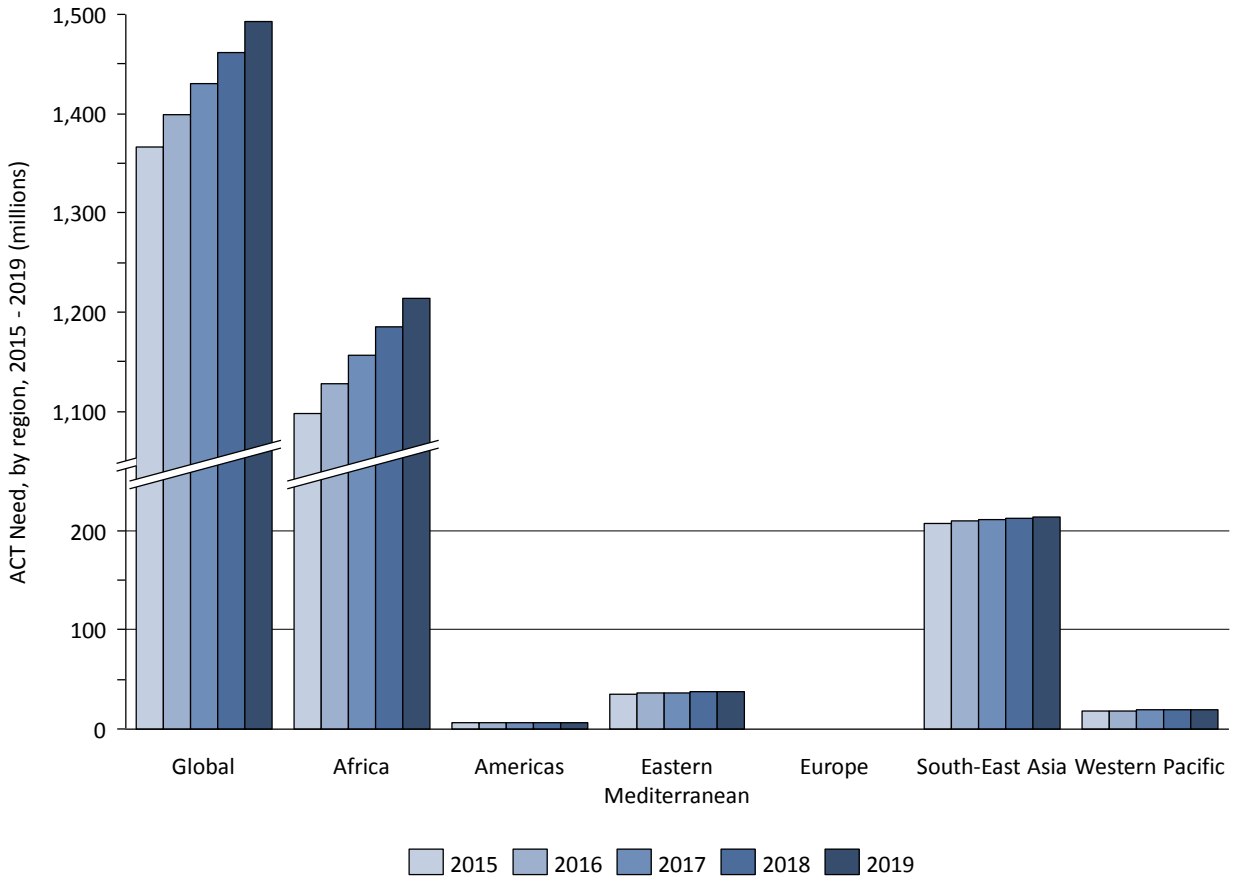


Figure 1 - ACT Need, by region, 2015 - 2019 (millions)

Although we estimate that South-East Asia has nearly twice as many annual incident fevers than Africa, Africa's malaria burden (and thus ACT need) is significantly higher than that in South-East Asia, owing to the African region's fever-adjusted prevalence being nearly tenfold higher than that in the South-East Asian region. In addition, ACT need expands at a faster pace in Africa (2.5% compound annual growth rate [CAGR]) compared to other regions (2%, 0.8%, and 1.3% CAGR in the Eastern Mediterranean, South-East Asia, and Western Pacific regions, respectively).

At the national level, we estimate that Nigeria has the largest overall number of incident fevers that have concomitant microscopy/RDT-detectable malaria infection (and thus, the largest national ACT need) (Figure 2). While malaria prevalence in India is relatively low and is mixed between *P. falciparum* and *P. vivax* infections (n.b. – all of the data sources and analyses in this report are focused on P. falciparum malaria), sheer volume of febrile illnesses and non-trivial falciparum-malaria prevalence leads to substantial figures for ACT need in this nation. The other high burden ACT need nations follow suit on the interaction between the annual volume of incident febrile illnesses and malaria prevalence.

Discussion: ACT Need

We defined ACT need as the number of anti-malarial medicines required to treat all febrile illness concurrent with a detectable (by microscopy or RDT) malaria infection, regardless of whether (a) the individual with the febrile illness sought treatment for that illness, (b) whether a febrile individual, having sought treatment, received any sort of diagnostic test to determine the cause of that illness, and (c) whether the tested individual actually received a course of anti-malarial treatment (or, more specifically, an ACT). In this context, the estimation of ACT need far exceeds estimated case figures owing to a number of potential factors including but perhaps not limited to: changing dynamics in malaria prevalence, or imprecision in extrapolating malaria prevalence among febrile illness from total population malaria prevalence, or inherent imprecision in our incident fever estimates. We would suggest that the ACT need figure of 1.37 billion in 2015 should be interpreted as a high ceiling to the overall need for anti-malarial medicines, rather than as a guide to a necessary volume of ACTs that must be achieved by manufacturers and whose procurement must be funded by governments and donor agencies. The point of this figure is to demonstrate that there exists a fairly large reservoir for potential malaria treatment need, and that while annual QAACT production currently exceeds case estimates, it comprises less than a third of the potential need for QAACTs if every febrile illness was tested and every malaria positive test were to be treated with an ACT.

ACT Demand

CHAI's anti-malarial/ACT need and demand model, based on extrapolation of data from national population-representative household surveys, produces estimates for a number of outputs, including annual incident fevers, the portion of those incident fevers that are likely to have a concomitant microscopy/RDT-detectable malaria infection, and the demand for diagnostic testing. The model uses household survey data on anti-malarial treatment in febrile children and an extrapolation to similar treatment in adults to arrive at global demand estimates for anti-malarial treatments (including ACTs). Using the CHAI model's forecast for global anti-malarial demand (1.3 billion in 2015, growing to 1.4 billion in 2019) and ACT demand (458 million in 2015, growing to 725 million in 2019) as a baseline (Figure 3), IMS has segmented the baseline forecast to provide more detail into the dynamics of global artemisinin and RDT demand. In terms of the geographical distribution of ACT demand, Africa represents the largest source of ACT demand with 352 million treatments in 2015, growing to 535 million treatments in 2019, and accounting for approximately 75% of global demand for ACTs. Furthermore, twenty countries comprise 80% of global ACT demand (Angola, Burkina Faso, Burundi, Cameroon, Chad, Côte d'Ivoire, DRC, Ethiopia, Ghana, India, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Sudan, Tanzania, Uganda, and Zambia).

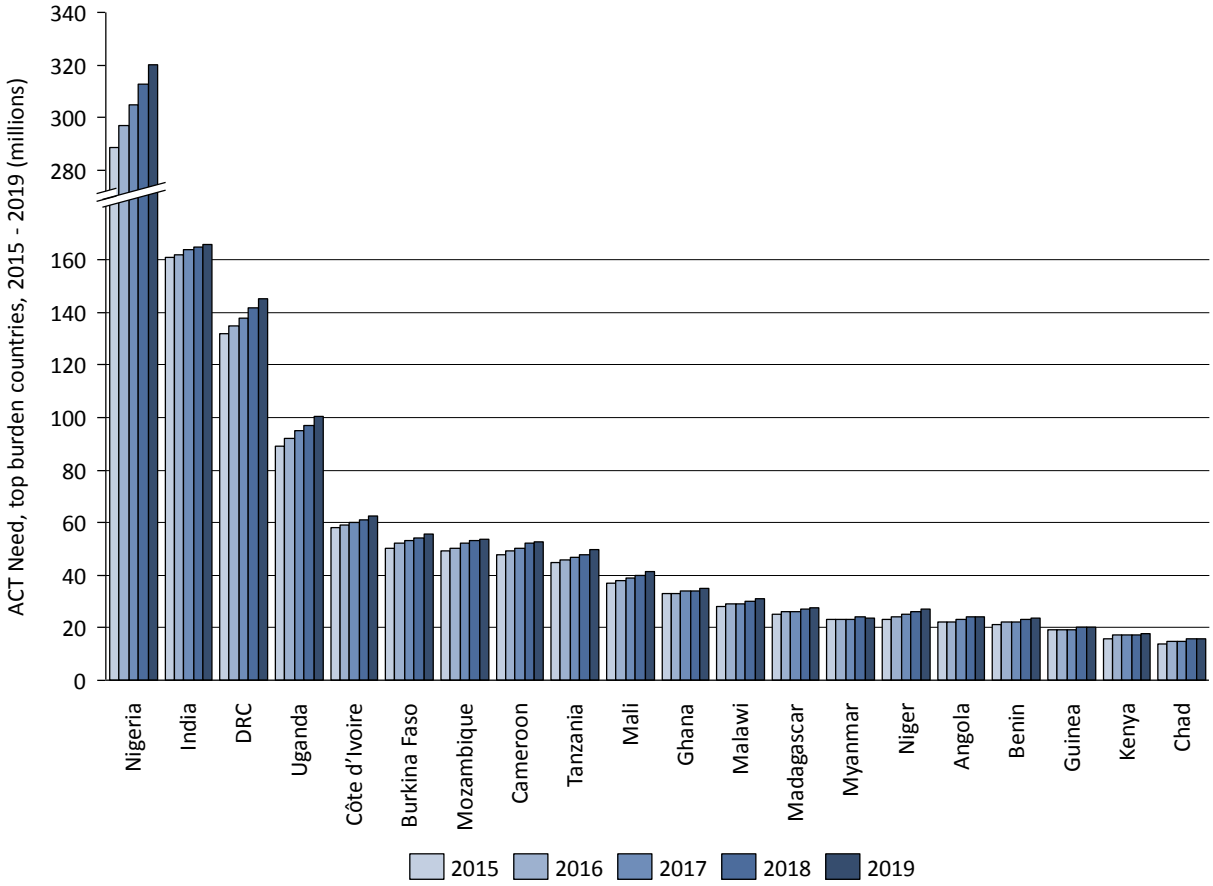


Figure 2 - ACT Need, top burden countries, 2015 - 2019 (millions)

The public sector remains the main the source of global ACT demand, accounting for approximately 60% of total ACT demand in 2015 (Figure 4). However, we expect that over the next four years, private sector ACT demand will grow faster than public sector demand, which will reduce the public sector's share of global ACT demand to 55% in 2019. Segmenting the two private channels, the private informal channel contributed the larger share of global ACT demand in 2015 (23%) while the private formal channel accounted for 17% of global ACT demand in 2015.

We have further segmented these data to estimate QAACT and non-QAACT demand across each of these three channels (Figure 4). While in some settings (e.g., Viet Nam), the majority or all of the public sector ACTs are non-QAACTs (volumes are relatively small), the majority of demand in the public sector is assumed to be for QAACTs. In forecasting QAACT vs. non-QAACT demand across distribution channels, to address the uncertainty around the demand for QAACTs in private sector sub-channels, we have applied upper and lower bounds on the use of non-QAACTs in the private formal sector. For the lower-bound case, we used IMS sales data to segment demand in the private formal and private informal channels by quality-assured drug classification: non-QAACTs make up approximately 30% of total ACT demand in ex-AMFm countries (Ghana, Kenya, Madagascar, Niger, Nigeria,

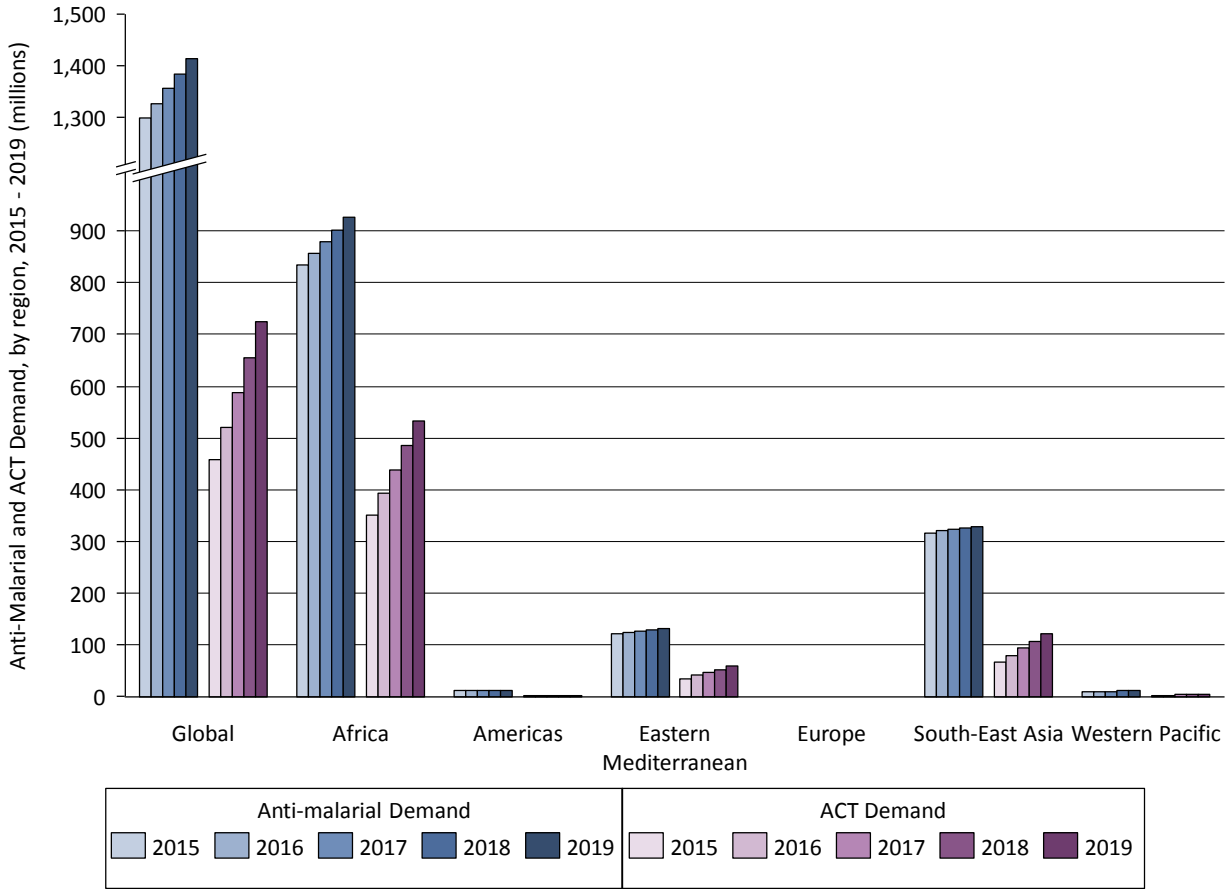
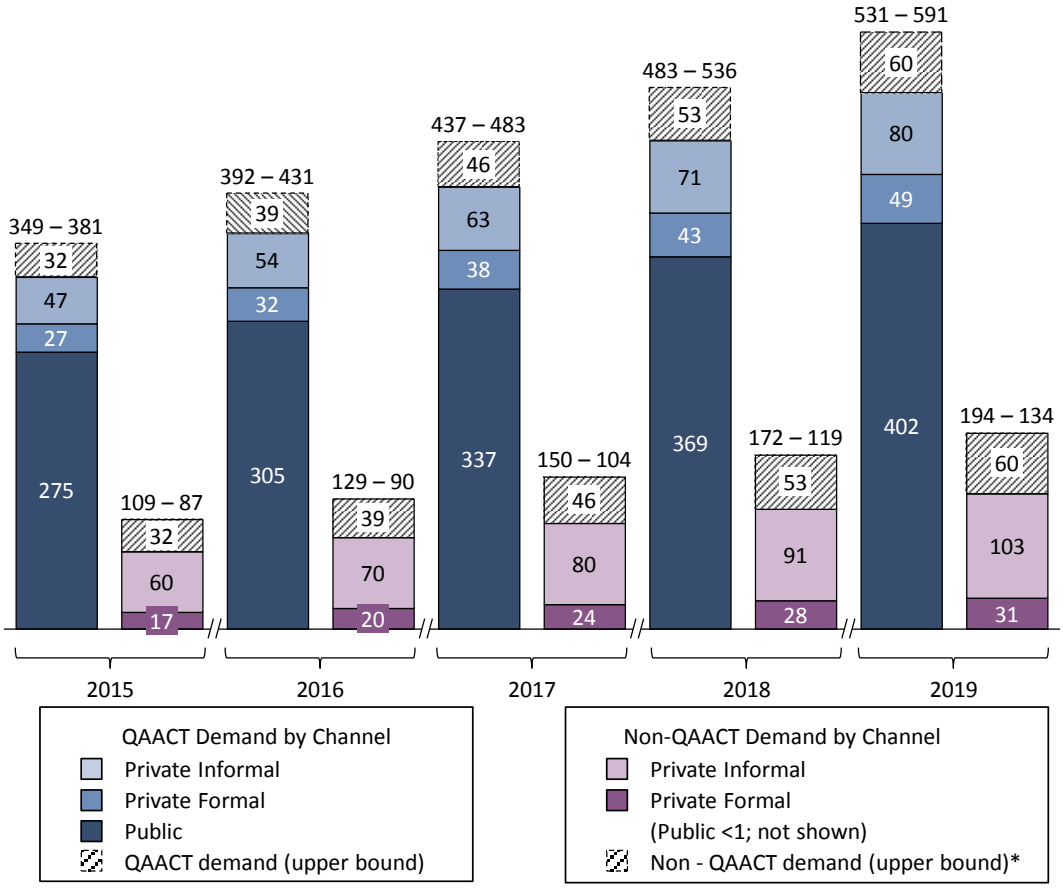


Figure 3 - Anti-Malarial and ACT Demand, by region, 2015 - 2019 (millions)

Tanzania and Zanzibar, and Uganda) and 76% of total ACT demand in non-AMFm countries. For the upper bound case, we used ACTwatch outlet survey data to make this distinction. The lower- and upper-bounds frame our QAACT demand forecast for the private market, with demand for 349 million QAACTs in 2015 growing to 531 million QAACTs in 2019 (upper bound growth: 381 million to 591 million QAACTs). Growth in demand for QAACTs will primarily be due to de-novo demand expansion, rather than shifts in demand away from non-QAACTs; our model projects overall growth in ACT demand, and sustained growth for non-QAACTs in the private channel.



Note: *Corresponds to lower bound QAACT demand

Figure 4 - ACT global demand, by Quality-Assured drug classification and distribution channel, 2015 - 2019 (millions)

Further segmenting our global QAACT demand forecast by specific product types (Figure 5), artemether lumefantrine will continue to comprise the majority of QAACT demand, with demand forecast to grow to 355 million treatments in 2019. We forecast ASSP demand to grow to 46 million treatments in 2019 with India comprising approximately 57% of ASSP use.

Discussion: ACT Demand

Using IMS's extensive private sector sales data, our analysis presents comprehensive, data-driven estimate for the portion of global ACT demand that is fulfilled by non-QAACTs. While the data supporting this analysis has limitations, the combination of IMS and ACTwatch data has allowed us to apply some basic assumptions around the use of QAACTs vs. non-QAACTs in the private and public sector, as well as the market share trends for various oral, parenteral, and rectal artemisinin monotherapies. We estimate that non-QAACTs comprise 24% to 26% of global ACT demand.

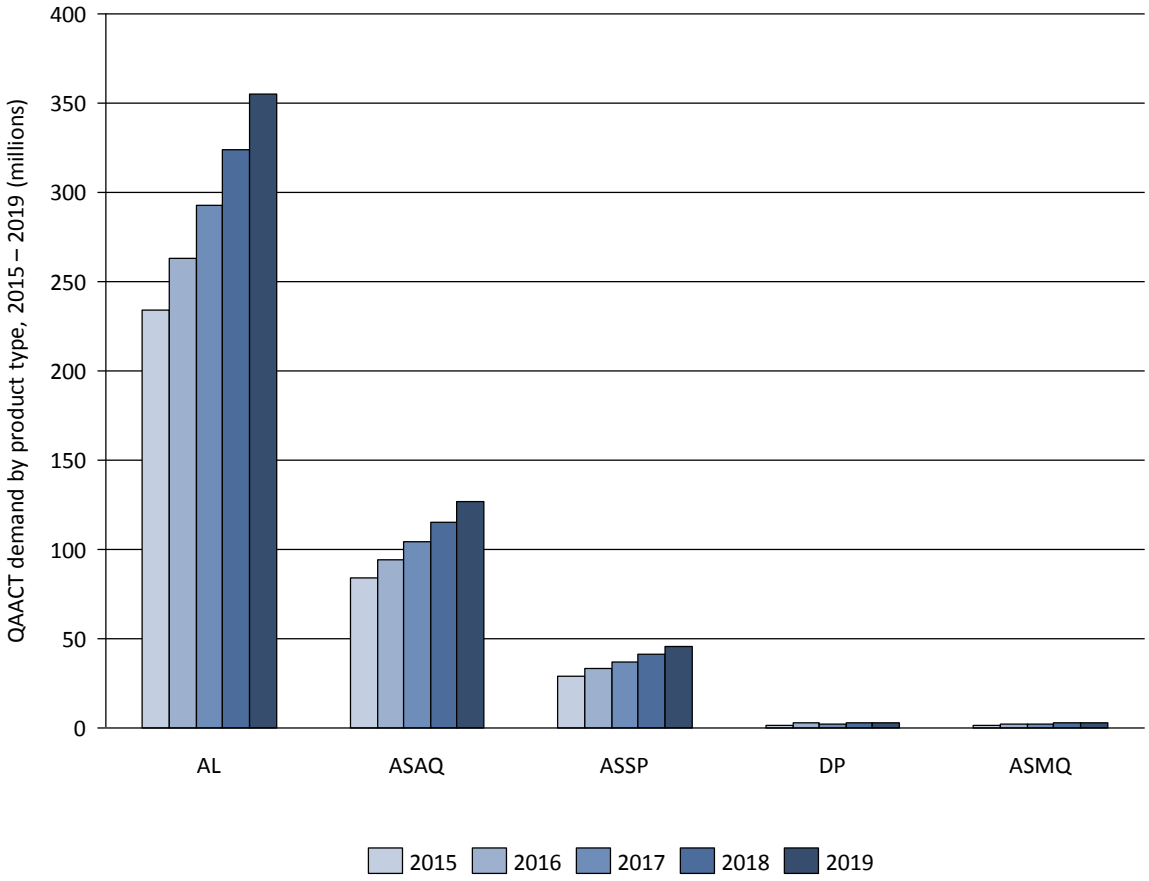


Figure 5 - QAACT global demand, by product type, 2015 - 2019 (millions)

Although population growth may be the main driver of the growth for our current model's ACT demand output, another significant driver is the use of ACTs by febrile patients who have no microscopy/RDT-detectable malaria. ACT over-treatment contributes significantly to ACT demand volume in the absence of effective strategies to reduce ACT use among febrile patients who are not diagnosed or those that receive a negative diagnosis. The dynamics between the uptake of diagnostic testing at point of care facilities and ACT demand will be explored as an event in a future iteration of this forecast report.

Our underlying model for anti-malarial and ACT demand applies treatment data collected from household surveys to an algorithm, also based on household survey data, that projects incident fevers and subsequent treatment seeking behavior and treatment algorithms. The model is not currently able to incorporate underlying changes in malaria prevalence, other than the gradual changes to malaria prevalence conferred

by increasing ACT access and use in malaria-positive patients. Given the limitations of the model, the main driver to ACT demand is thus population growth, which is positive, and hence, the model outputs positive growth trends for ACT demand over time.

QAACT Procurement

The model that we use to estimate global QAACT procurement is based on the following data inputs:

- Estimates of the available financing from the Global Fund to fight AIDS, Tuberculosis, and Malaria (GFATM) and USAID's President's Malaria Initiative (PMI) for public sector procurement of QAACTs;
- Public sector procurement plan data for individual countries that procure QAACTs through the use of funds from the GFATM;
- Historical QAACT spending on GFATM grants;
- Historical QAACT procurement through PMI;
- For the private sector in countries taking part in CPM, estimates of the CPM funding, procurement based on historical funding / procurement and co-payment plans where known;
- For the premium private sector (in countries not taking part in CPM), the QAACT portion of ACT demand in the private sector, based on the QAACT portion of ACTs, calculated based on private sector sales volumes tabulated by IMS, and applied to outputs from the ACT demand model (described above).

Our approach uses GFATM data on nationally planned procurement volumes and product mix, and applies assumptions on QAACT pricing and associated procurement costs (based on publicly available GFATM data and data from NMCPs) to calculate the total allocation of funds for commodity procurement. Applying historical trends in grant disbursements, we estimate the average pace and value of future grant disbursements at the national level, and from these figures, arrive at an annual estimate for QAACT procurement. In countries for which we do not have procurement plan data on which to base current funding allocations, we use data from past GFATM

grants to extrapolate historical spending on ACTs as a percentage of total malaria programmatic funding; by applying these estimated commodity spending rates to projected disbursements and incorporating price assumptions, we arrive at projections for QAACT volumes in these countries.

Because PMI usually plays a gap-filling role in the treatment commodity procurement space, and programmatic plans are often modified to fill developing gaps in treatment coverage, we apply trends in national QAACT procurement over the past few years to the forecast years to forecast procurement via PMI funds. While financial commitments for the continuation of CPM QAACT procurement are unclear beyond 2016, we have assumed that in CPM-participating countries, subsidized private sector QAACT treatment volumes in 2017 –2019 will be equivalent to 2016 estimations. On QAACT procurement volumes in the premium private sector, there is very little available data; we have developed lower-bound and upper-bound assumptions to address this uncertainty and to frame our QAACT procurement forecast for the premium private market.

Our lower bound QAACT procurement forecast (which we also consider the base case) projects 378 million QAACTs to be procured across all channels in 2015, with this figure peaking at 457 million in 2016 before declining to 431 million, 390 million, and 387 million QAACTs in 2017, 2018, and 2019, respectively (Figure 6). Our upper bound case projects forecasts 407 million QAACTs to be procured in 2015, with this number peaking to 492 million in 2016 before declining to 473 million, 440 million, and 443 million in 2017, 2018, and 2019, respectively. The underlying difference driving these outputs is a varying assumption for the QAACT comprising proportion of ACT procurement in the premium private sector.

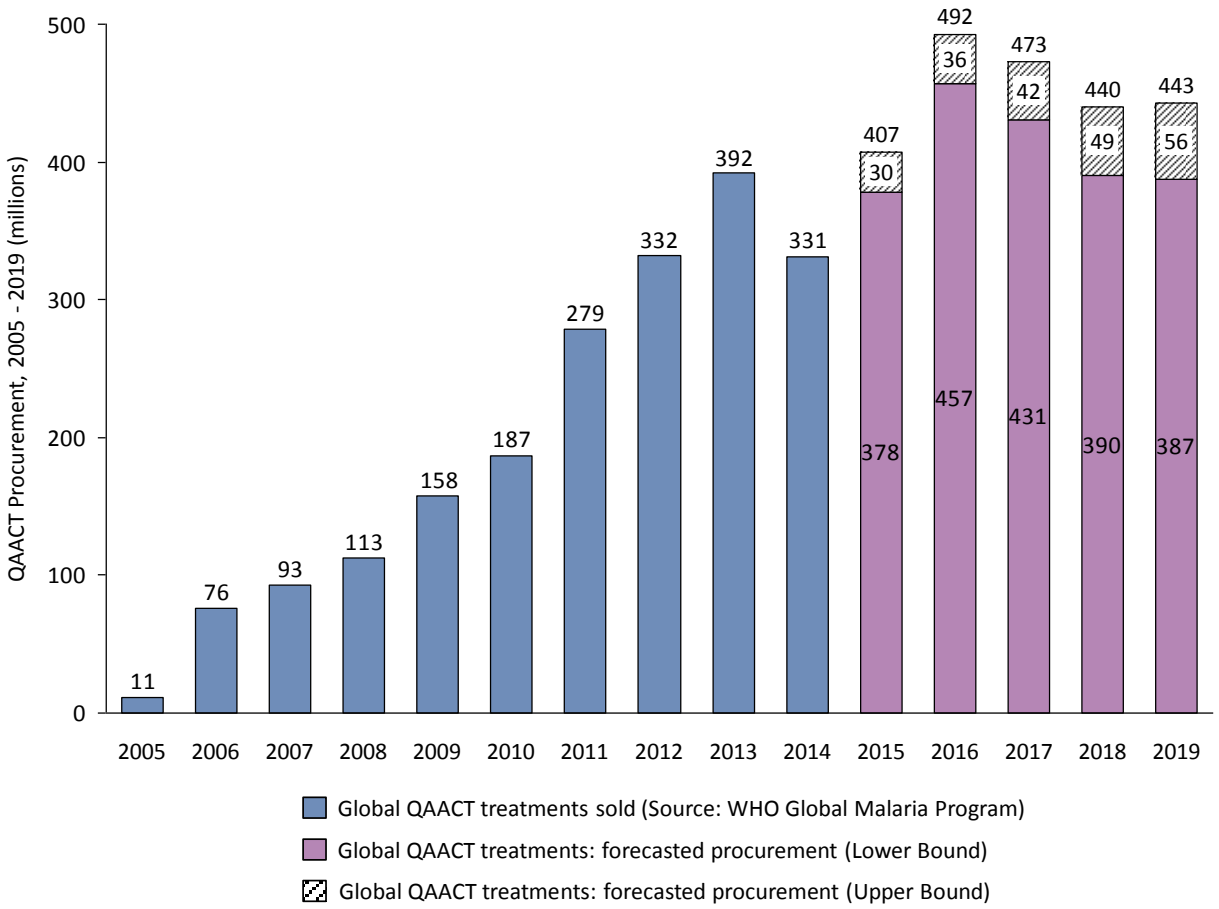


Figure 6 - QAACT market: Historical and forecast growth, 2005 – 2019 (millions)

In 2015, QAACT procurement is highest in the public sector followed by the private subsidized sector (CPM) and the premium private sector (Figure 7). Although the prices of ACTs have come down substantially, they are still expensive and cost much more than other sub-optimal anti-malarials, which explains the relatively low volumes in the private non-subsidized sector (premium private sector). Growth in QAACT procurement from 2015 to 2016 is largely driven by planned procurement in the public sector, and the African region will continue to constitute the majority of QAACT treatments procured in the public sector as a handful of high-volume African countries plan to increase funding allocations for ACT procurement in 2016. The subsequent decrease in 2017 and 2018 is also driven by a decrease in projected funding allocation for ACT procurement in the public sector, as the model applies country-specific historical spending to current funding envelopes to forecast available funds for procurement in 2017, 2018, and 2019.

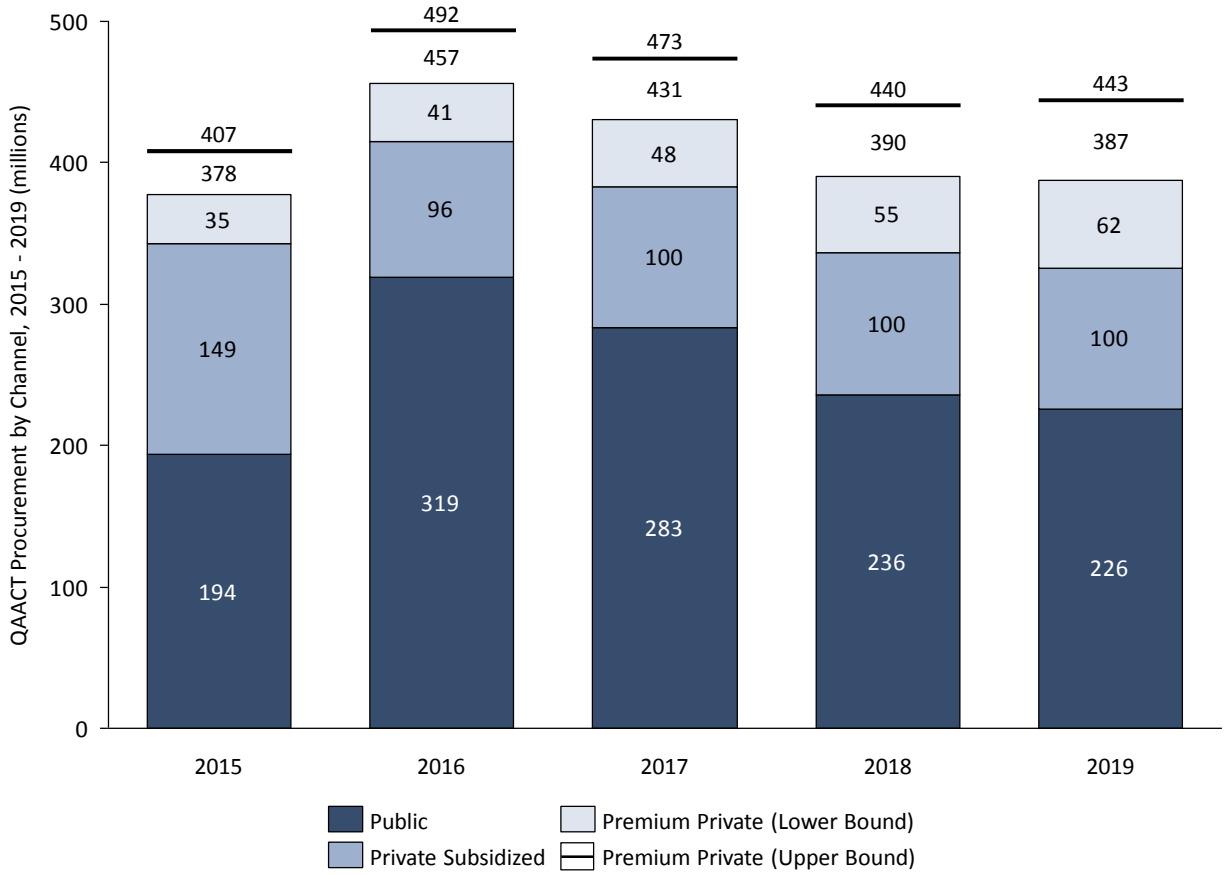


Figure 7 - QAACT procurement, by channel, 2015 - 2019 (millions)

Artemether-Lumefantrine will continue to dominate the QAACT market, despite the increase in ASAQ procurement expected in 2016/2017 (Figure 8). The expected increase in ASAQ procurement is driven by an increase in planned procurement in the public sector among a handful of African countries which have ASAQ as the first line treatment, with DRC accounting for the largest increase.

While our model has incorporated as many data as were available to us, it still relies upon extrapolation and assumptions that are based on historical data that might not be predictive of future trends; financial information from grant applications and procurement plans from past GFATM grants does not necessarily reflect actual procurement volumes using those funds. We have tried to reconcile this by using actual procurement data, where available, and have erred on reliance on actual procurement trends rather than trends outlined in commodity procurement plans.

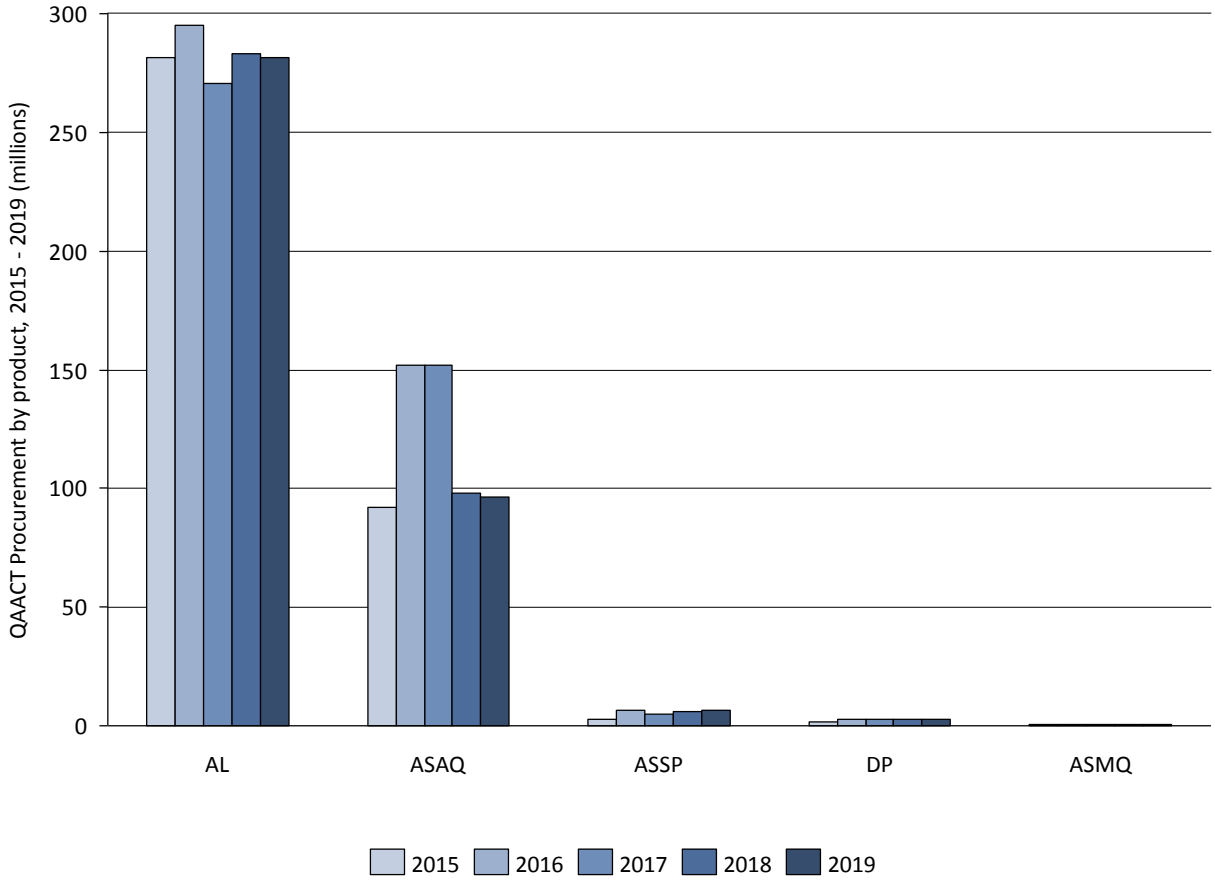


Figure 8 - QAACT procurement, by product type, 2015 – 2019 (millions)

GFATM grants have a three-year lifespan, and grant start and end dates are staggered according to when countries/principal recipients applied for the grant. We have adopted the non-synchronized GFATM grant timelines and incorporated estimates for the timing of the next round of concept note submissions, at the national level. While future GFATM funding replenishments may bring significant changes to the overall availability of GFATM funds for malaria programs, national funding envelopes, and country allocations for commodity procurement, we have adhered to a conservative approach: we expect future funding envelopes will be similar to today's existing funding envelopes, and we expect that commodity funding allocations and the pace and product mix for procurement will be similar to that of today.

Discussion: QAACT Procurement

Most QAACTs are procured using funds from donor organizations such as the GFATM or PMI, and therefore our procurement forecasts are based on projections for available funding. With the transition to the GFATM's new funding model in 2014, countries now have more stable expectations around funding envelopes, and the annual disbursement mechanism supports more regular procurement of essential medicines. However, with the launch of

the new funding model, some countries entered this funding cycle with prior existing funds while others were facing funding gaps that required acute attention. Thus, some countries have planned procurement to cover their needs for two years of a three-year funding cycle, with the aim of renewing funding for continuous procurement prior to the third year in the cycle. 2016 will be a peak year for QAACT procurement, as a number of countries complete their planned procurements on the current funding cycle while some large-volume countries (e.g., DRC) simultaneously begin a two year QAACT procurement surge.

One of the interesting effects of the GFATM's new funding envelope scheme is that it has perhaps shifted the financial-geographical-product balance in the ACT market. In 2010 – 2013, when the AMFm was ongoing, approximately 80% of GFATM funding for QAACTs was targeted at a handful of countries, most of them using AL as their recommended first-line therapy for uncomplicated malaria. With the transition of the AMFm to the CPM program, QAACT procurement funding for this handful of countries has declined and the introduction of the funding envelopes has made procurement plans from other high-burden countries more prominent, some of them using ASAQ as their recommended first-line therapy. Thus, while AL will continue to dominate the QAACT market, we expect that ASAQ volumes will increase in 2016 and 2017 with planned procurements in DRC and other nations that have adopted ASAQ as their first-line therapy.

Because we have little information about the magnitude of the next GFATM replenishment, nor what the future allocations will be for each disease area or country funding envelope, we have applied historical ACT spend, by country, to existing country funding envelopes to project QAACT procurement beyond 2017. There are obvious uncertainties inherent in this method, and the impact of these uncertainties will be explored in a follow-on forecast report where we model sensitivities of QAACT procurement to changes in funding cycles.

Artemisinin Monotherapy Demand

Despite guidance from the WHO for the market withdrawal of oral artemisinin-based therapies to halt the spread of artemisinin resistance, there is still evidence, observed through sales data collected by IMS, of continued, albeit declining, use of oral artemisinin monotherapies (Figure 9). Oral artemisinin monotherapy use is forecast to decrease in all regions as a result of efforts to phase out these medicines. We forecast demand for oral artemisinin monotherapy, which is highest in Africa, will decline in this region from 658,000 treatments in 2015, to 290,000 in 2019.

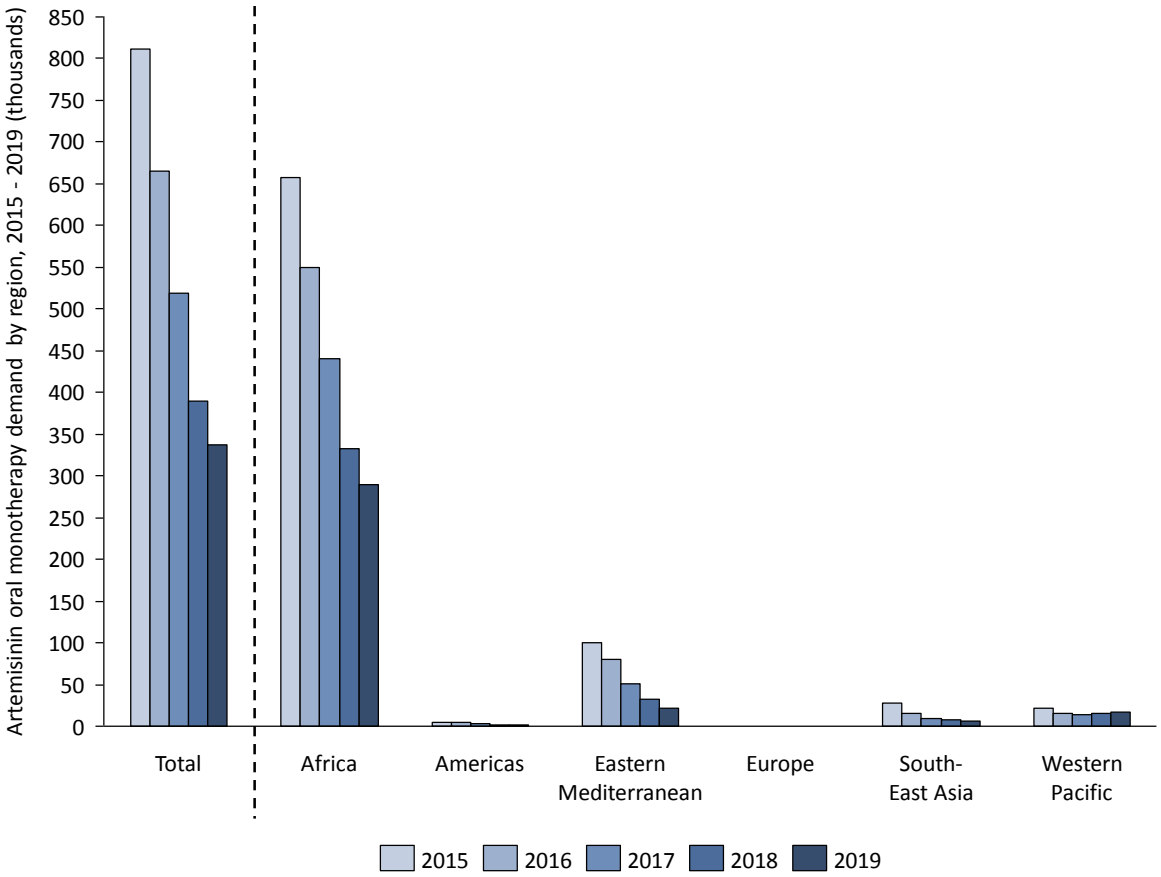


Figure 9 - Artemisinin oral monotherapy global demand, by region, 2015 – 2019 (thousands)

We have assumed that there is little to no use of oral artemisinin monotherapies in the public sector (Figure 10). We used IMS data to calculate the proportion of oral artemisinin monotherapy out of the total oral artemisinin demand in the private sector; this proportion has been applied to both the private formal and private informal channels. This results in a forecast demand of approximately 337,000 oral artemisinin monotherapies across both private sector channels in 2019.

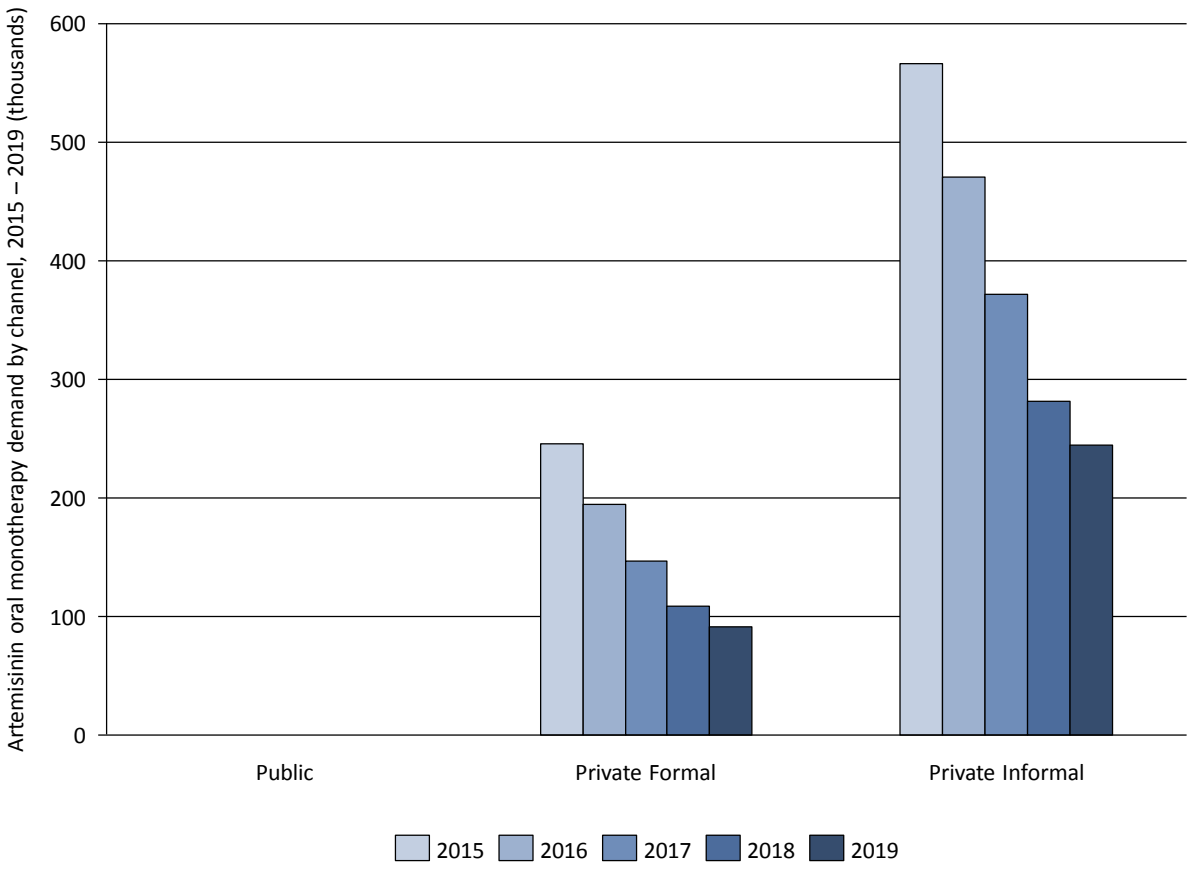


Figure 10 - Artemisinin oral monotherapy global demand by channel, 2015 – 2019 (thousands)

We forecast demand for injectable artemisinin-derivative products is 53 million (unit: 60mg. vials) in 2015 and will increase to 95 million vials in 2019 (Figure 11). Demand for rectal artemisinin-derivative products and we forecast it too will increase, from 9.8 million total suppositories (units: 80mg. artemether; 100mg. artesunate) in 2015 to 11.6 million suppositories in 2019 (Figure 12). We estimate the demand for both injectable and rectal artemisinin in the private sector by calculating their demand as a proportion of oral artemisinin demand (including ACTs), and applying this proportion to the forecast for oral artemisinin demand. We use IMS sales data to estimate injectable and rectal artemisinin demand in the private sector, and a combination of IMS data and publicly available GFATM data to estimate demand in the public sector.

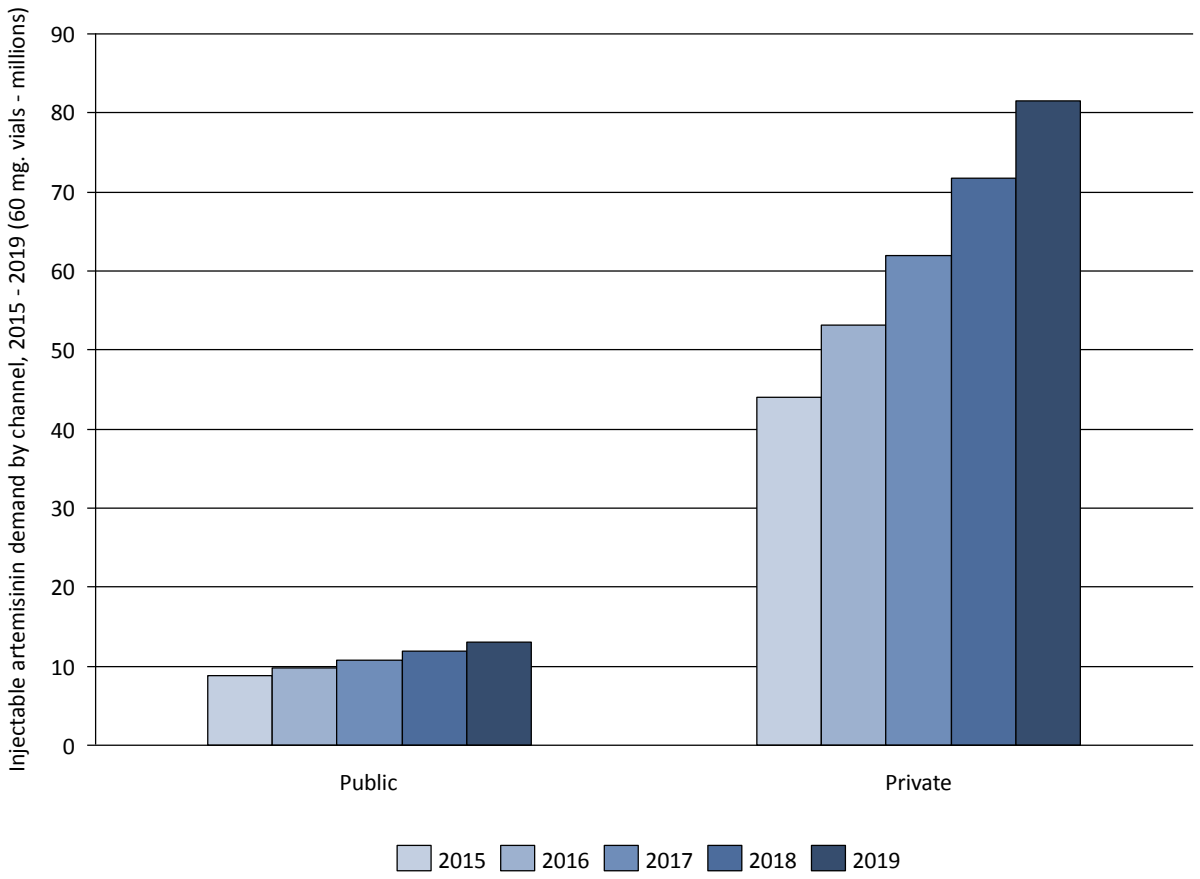


Figure 11 - Injectable artemisinin demand, by channel, 2015 - 2019 (60 mg. vials - millions)

Discussion: Artemisinin Monotherapy Demand

Despite guidance from the WHO for the withdrawal of oral artemisinin-based therapy to halt the spread of artemisinin resistance, oral artemisinin monotherapies are still manufactured, sold, and administered across the globe. However, there is good news on this front: we expect that demand for these unfavorable medicines will continue to decline. With on-going efforts to reduce their usage, we forecast demand for oral artemisinin monotherapies will drop from 811,000 treatments in 2015 to 337,000 treatments in 2019. Since historical trends have been used to forecast future monotherapy demand, this figure is likely to be heavily impacted by regulatory initiatives that aim to reduce the usage of monotherapies. While the estimated demand volumes for injectable/rectal artesunate may exceed severe malaria case loads, current sales data for this class of medicines indicate that there is likely to be some off-label use.

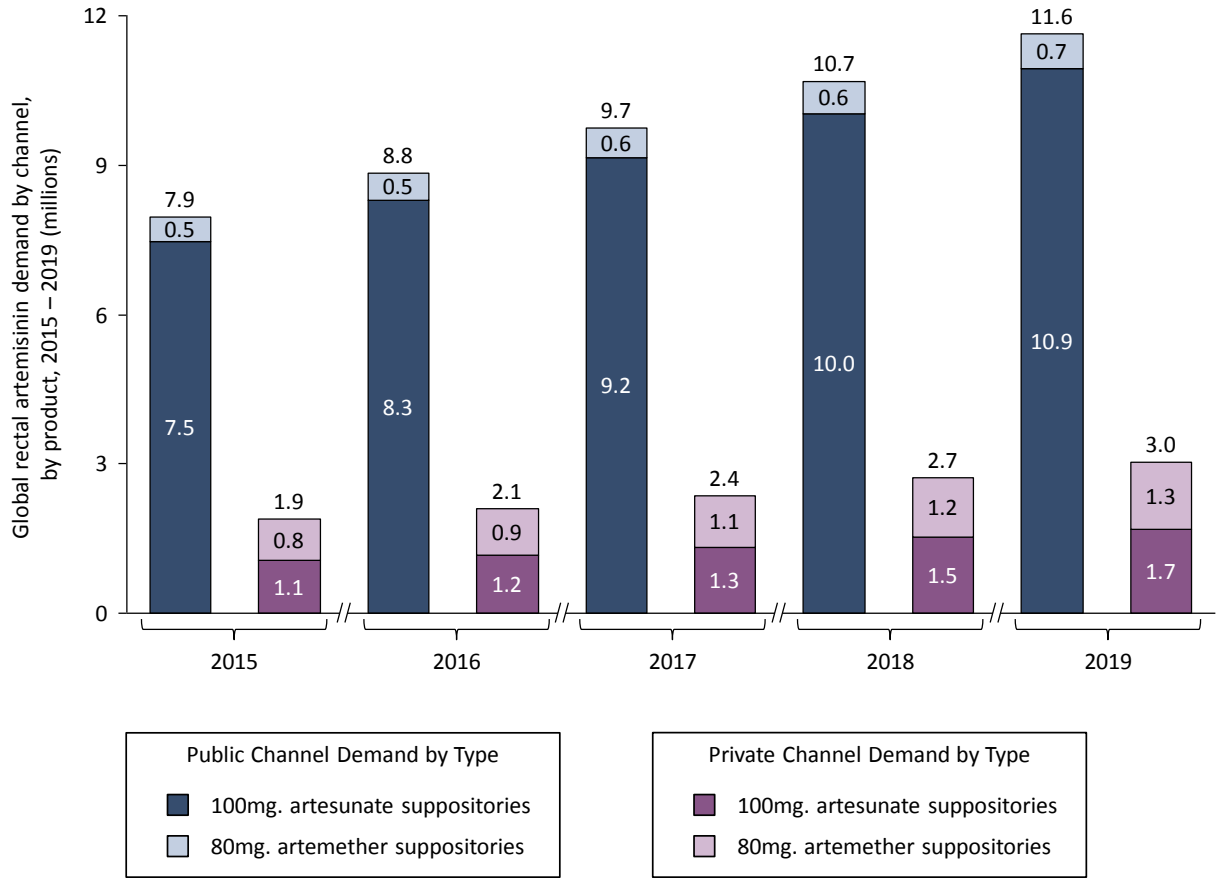


Figure 12 - Global rectal artemisinin demand by channel, by product, 2015 – 2019 (millions)

QA-Injectable Artesunate Procurement

Since the publication of the seminal SEAQUAMAT and AQUAMAT clinical trials, which demonstrated that replacing administration of quinine with injectable artesunate, in treatment of patients with severe malaria, resulted in 34.7% and 22.5% reductions in in-hospital adult and child mortality respectively (1,2), there has been a concerted effort to engage national malaria control programs and advocate for the revision of treatment guidelines toward recommending injectable artesunate as the preferred treatment for severe malaria.

Because the market for quality-assured injectable artesunate remains fairly young, there are few data on which to base assumptions around product uptake. Therefore, we have used current GFATM procurement plans from high burden countries, as well as data from PMI and UNITAID, to build our forecast projections. We do not currently estimate the private sector procurement of QA injectable artesunate but expect that it will be a small fraction of the public sector.

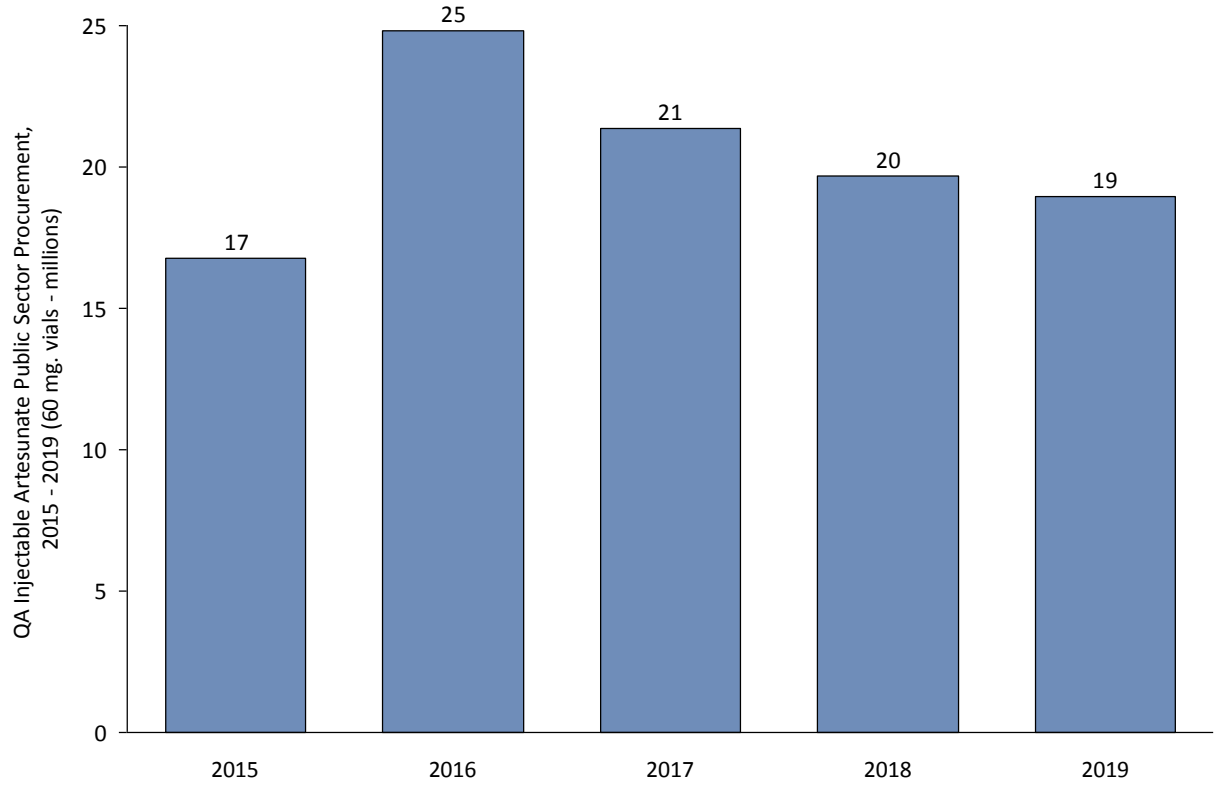


Figure 13 - QA injectable artesunate public sector procurement, 2015 - 2019 (60 mg. vials - millions)

We forecast public sector QA injectable artesunate procurement to be 17 million 60 mg. vials in 2015, with this figure peaking at 25 million in 2016 before declining to 21 million and 19 million 60 mg vials of QA injectable artesunate in 2017 and 2019, respectively (Figure 13). Growth in QA injectable artesunate procurement from 2015 to 2016 is largely driven by a planned increase in GFATM funding allocations towards injectable artesunate procurement in 2016. The decrease in QA injectable artesunate procurement between 2016 and 2017 is driven by a forecasted decrease in GFATM funding allocation towards QA injectable artesunate procurement.

The African region will procure the majority of QA injectable artesunate in the public sector (Figure 14). The Eastern Mediterranean region will also procure a significant volume of QA injectable artesunate; however, this is procurement that will come largely from countries on the African continent – Sudan and South Sudan.

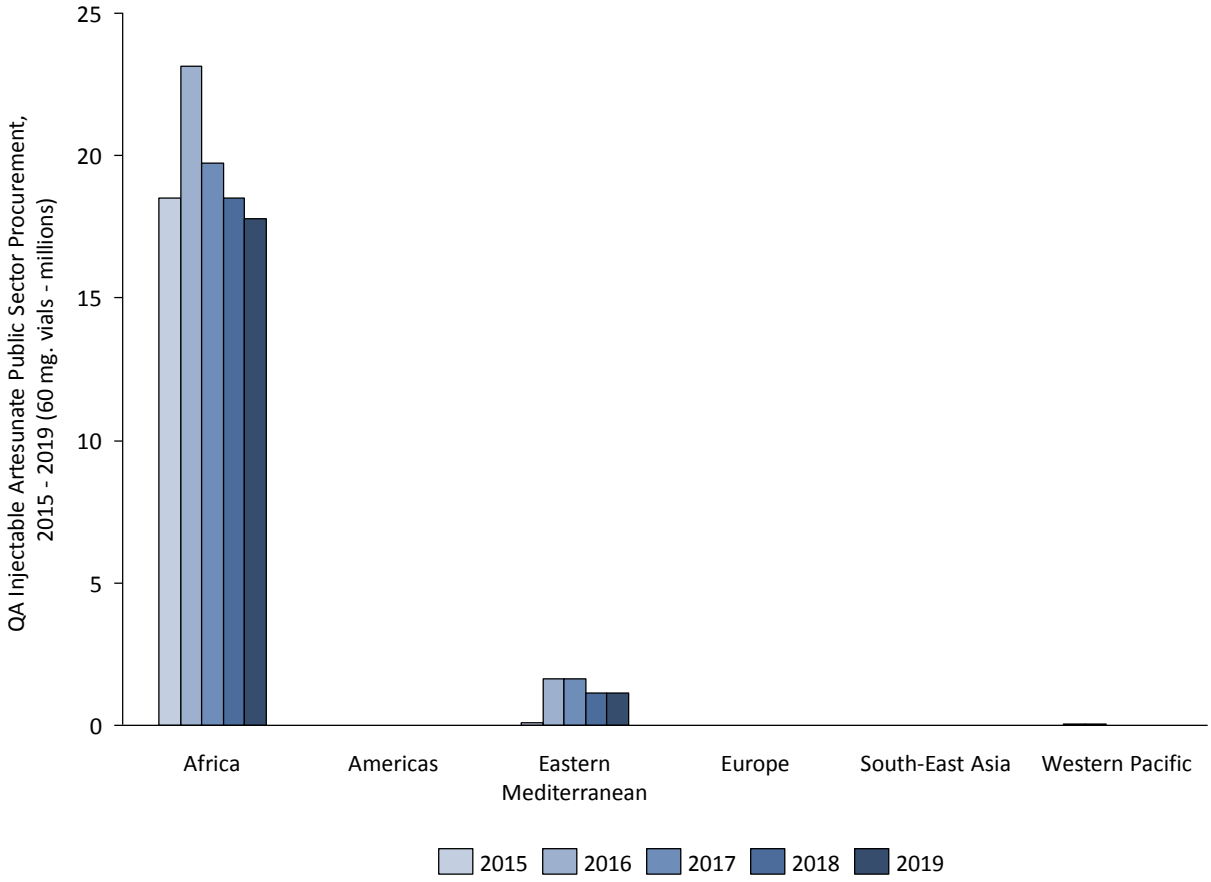


Figure 14 - QA injectable artesunate public sector procurement, by region, 2015 - 2019 (60 mg. vials - millions)

Discussion: QA Injectable Artesunate Procurement

Over the past few years, there has been a significant push to switch the first-line therapy for severe malaria from injectable quinine to injectable artesunate. This program has been largely successful (Full disclosure: UNITAID has made significant investments in this space, including funding some of Medicines for Malaria Venture (which has representation on this project's steering committee) and CHAI's work in this space), and a number of countries have revised treatment guidelines, leading to an increase in procurement of QA injectable artesunate. While we currently forecast a peak flowed by a slight decline in QA injectable artesunate procurement, the decline is due to anticipated shifts during funding transitions, and we expect that the QA injectable artesunate market will stabilize with annual volumes about midway between current volumes and 2016 peak volumes.

RDT Demand

CHAI's anti-malarial/ACT need and demand model includes fever testing by channel as an output. We have combined this with information from the World Malaria Report on the proportion of diagnosed cases that are examined using RDTs to estimate the number of tests carried out with RDTs. Due to the lack of information on RDT usage across the different channels we have applied the same calculated proportion across all three channels. Overall, the majority of RDT testing is forecast to take place in the public sector, reaching 335 million tests in 2019, and accounting for approximately 75% of all RDT testing (Figure 15). Without the addition of new interventions focused on RDT uptake in the private sector, RDT use in this channel is likely to remain flat.

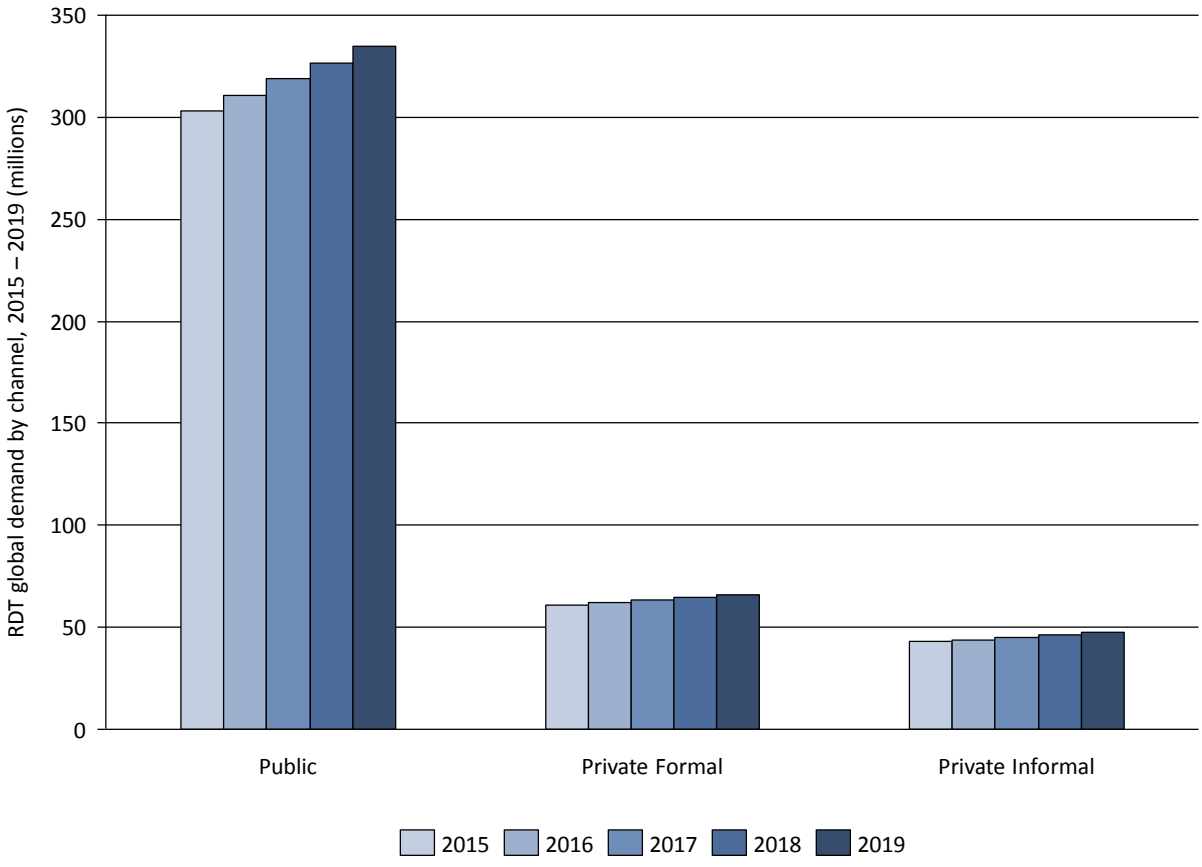


Figure 15 - RDT global demand, by channel, 2015 - 2019 (millions)

RDT demand is highest in Africa, where we forecast it will reach 359 million tests in 2019 (Figure 16). This reflects the high number of tests carried out in this region as well as the relatively higher share of RDT testing in the Africa region compared to other regions: 57% RDT share in Africa vs. 43% average across all regions.

Discussion: RDT Demand

We estimate that 75% of all RDTs are currently used in the public sector. We forecast demand for RDTs will expand from 303 million RDTs in 2015 to 327 million tests in 2018. Expansion of RDT availability and use in the private informal sector remains a challenge, though some countries, like Tanzania and Kenya, are beginning to make inroads in this sector. Comparing our RDT demand forecast to our RDT procurement forecast exposes different outcomes based on two differing approaches. The RDT demand forecast is based on historical data on diagnostic testing as well as historical share of RDT use among diagnostic testing methods. Assumptions based on these data are projected forward in our patient-based decision tree model to estimate the number of incident febrile treatment-seeking episodes that are tested with an RDT per year. This model does not incorporate new initiatives undertaken by governments wanting to expand RDT use in the public or private sector, and as such may forecast demand that is at times lower than our procurement figures.

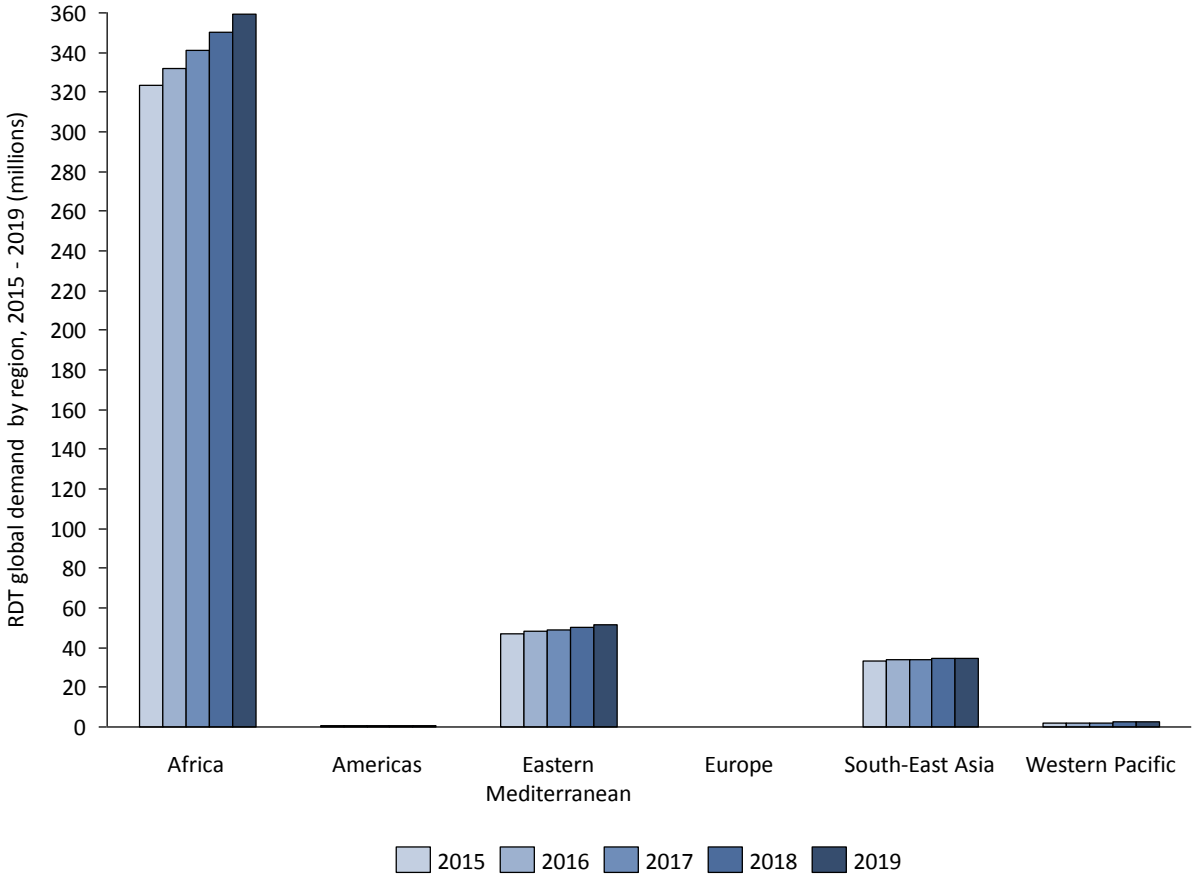


Figure 16 - RDT global demand by region, 2015 – 2019 (millions)

RDT procurement

As is the case with QA-injectable artesunate procurement, the past few years have witnessed rapid growth in the malaria RDT market. Our forecast model uses a similar approach as that used for QAACTs with the key data inputs being available funding for the procurement of RDTs and RDT procurement plans or historical procurement data (from the GFATM and PMI). For the private sector, we have applied the RDT share of testing (calculated from the World Malaria Report) to the private sector test forecast outputs from the demand model (described above).

We forecast global RDT procurement to be 281 million in 2015, peaking at 384 million in 2016, remaining flat at 375 million in 2017, before declining to a plateau around 328 million RDTs in 2018 and 2019 (Figure 17). Growth in RDT procurement from 2015 to 2016 is largely driven by increased planned procurement in the public sector, primarily in Africa (Figure 18). Conversely, the decrease in RDT procurement from 2017 to 2018 is driven by a

decrease in projected funding allocation for RDT procurement in the public sector in 2018, as the model applies average historical spending (which is generally lower) to current funding envelopes to forecast available funds for procurement in 2017 – 2019.

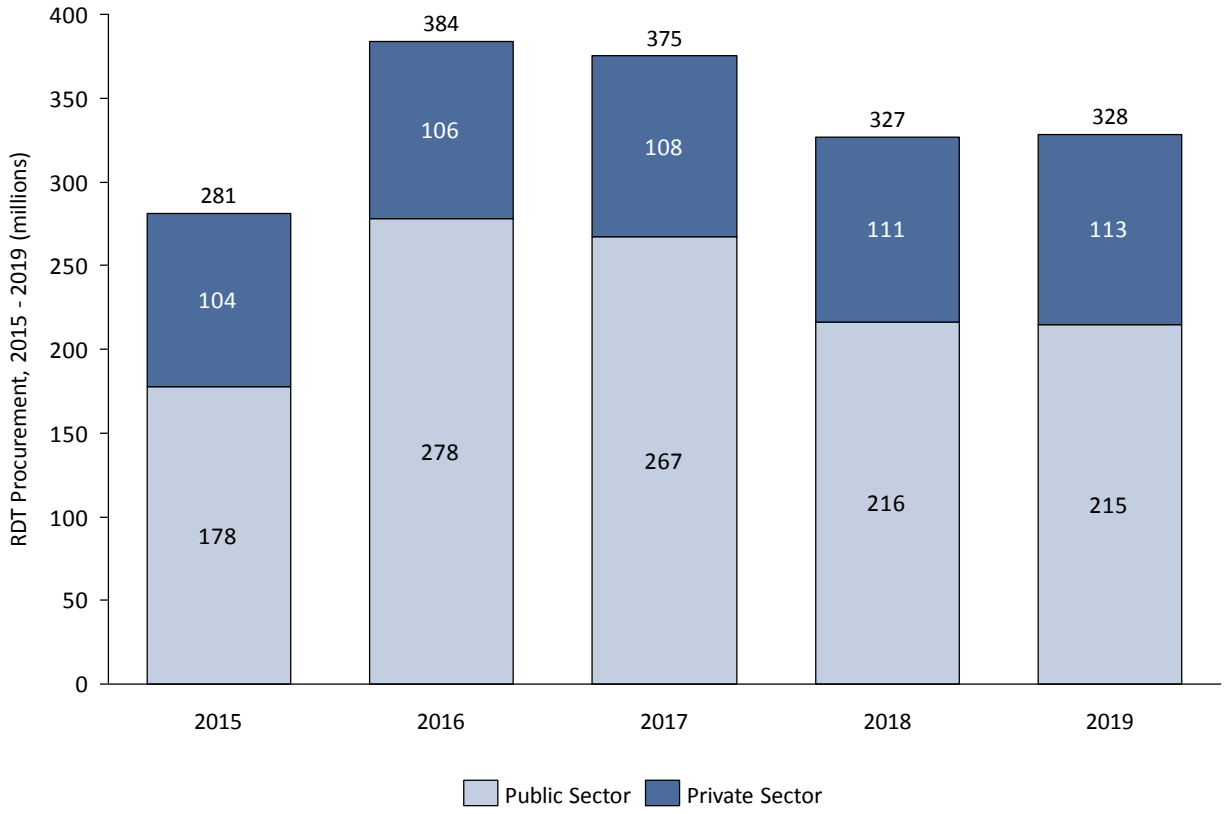


Figure 17 - RDT procurement by channel, 2015 - 2019 (millions)

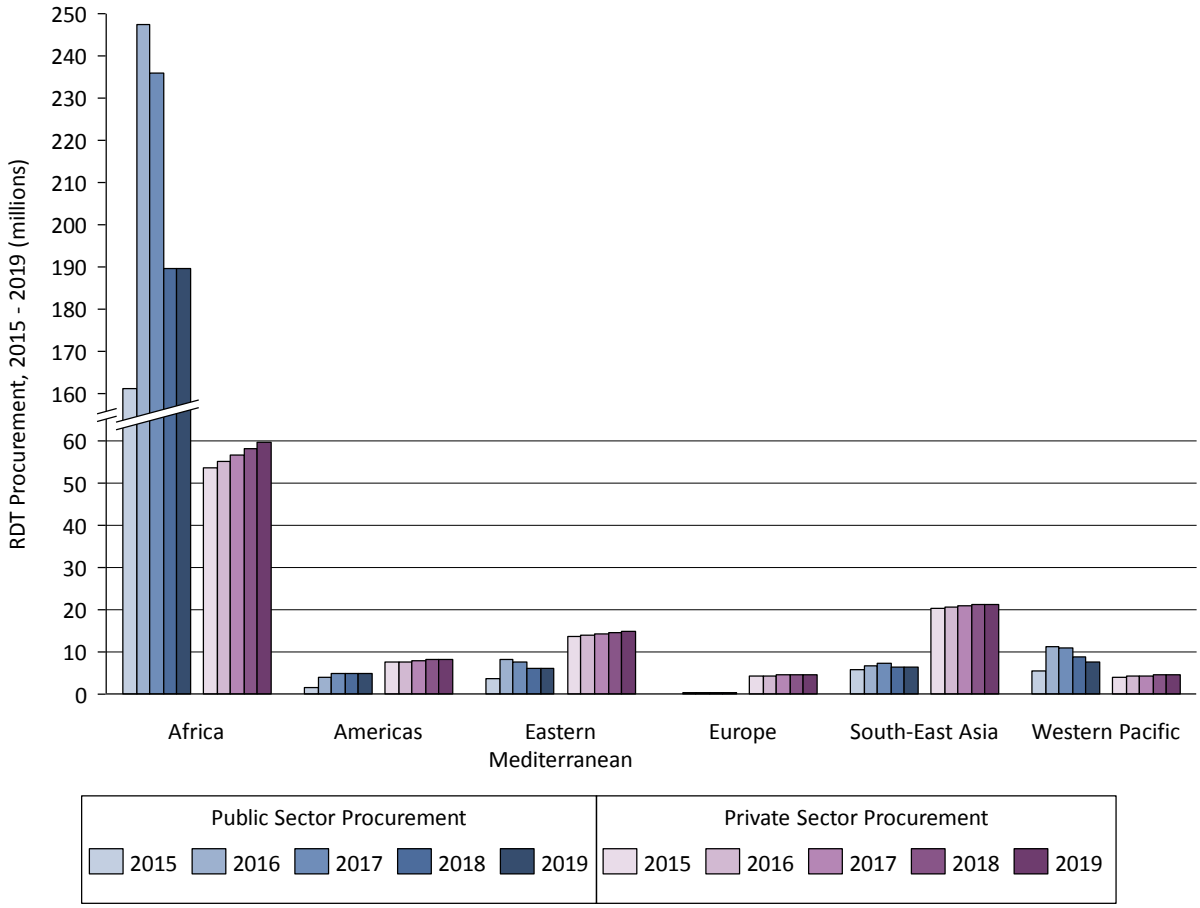


Figure 18 - RDT procurement by region, by channel, 2015 - 2019 (millions)

Discussion: RDT Procurement

We forecast RDT procurement will peak in 2016, driven by the same country procurement plan and budgeting dynamics that will lead to a peak in QAACT procurement in 2016. Because we have little information on funding allocations and country procurement plans beyond 2017, our forecast relies on recent historical procurement and funding allocations to estimate future procurement. Therefore, while it does incorporate ongoing initiatives that have been driving uptake of RDTs in some channels and settings for the past few years, it does not generalize trends in recent RDT uptake across all countries in the model, and therefore, may underestimate procurement if additional high-volume countries shift their procurement and case management strategies toward expanding RDT use more broadly. We plan to explore the dynamics between expanded access to RDTs and ACT demand and procurement in a future iteration of this forecast report.

Artemisinin Demand for API

Global demand for Artemisinin can be calculated by tabulating the number of QAACT treatments that will be procured (taking into account the dosage/strength of each commodity) in a given year, summing this figure with projections of demand for non-QAACTs, injectable-artesunate, and artemisinin monotherapies, and converting these estimates to API demand using the process yields commonly associated with industrial conversion of raw artemisinin to its various derivative products (process yields obtained in communication with industry experts):

	Efficiency of conversion from Artemisinin to Artemisinin Derivative
Artemether	80%
Artesunate	106%
Dihydroartemisinin	80%

In addition to the efficiency of conversion from artemisinin to artemisinin derivative, our artemisinin demand calculation also accounts for a 5% material loss that occurs during conversion of artemisinin derivative APIs to oral, parenteral, or rectal formulations, and during packaging of such treatments.

Among artemisinin derivatives, artemether has the highest demand, driven by artemether/lumefantrine being the most widely used ACT (Figure 19). We forecast global demand for artemisinin will rise from 197 metric tons in 2015 to 229 MTs in 2016, and remain stable at 227 MTs, 232 MTs, and 242 MTs in 2017, 2018, and 2019, respectively (Figure 20). We have assumed that the efficiencies in converting artemisinin to its derivative products will remain constant throughout the forecast period, and as such, the change in global demand for artemisinin is a function of change in procurement of QAACTs and demand for non-QAACTs, injectable artesunate and artemisinin monotherapies.

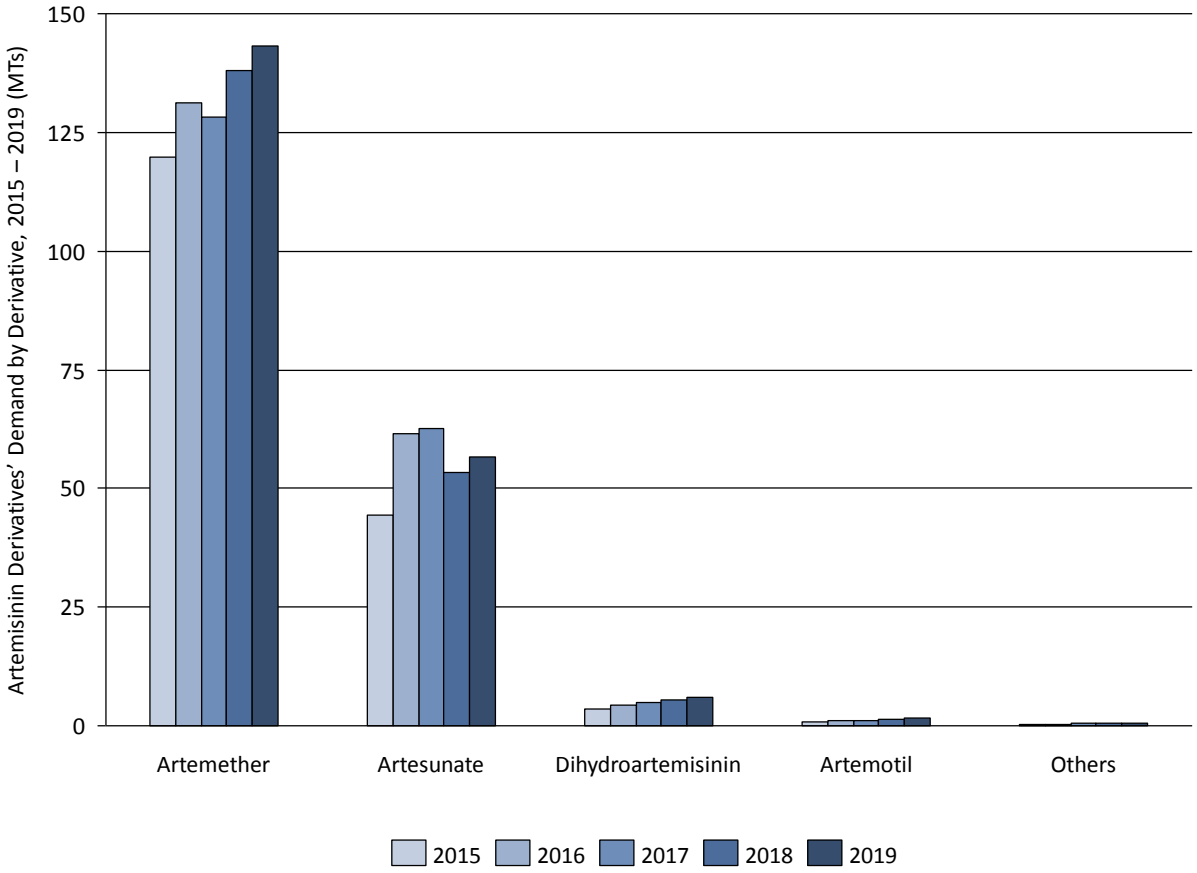


Figure 19 - Artemisinin derivatives' demand by derivative, 2015 – 2019 (MTs)

Discussion: Artemisinin Demand

We have leveraged our ACT, oral artemisinin monotherapies, and injectable/rectal artesunate forecasts to estimate the global demand for artemisinin, and forecast 197 metric tons of artemisinin was required to meet global demand for artemisinin-containing medicines in 2015. With the forecast growth in procurement of QAACTs and demand for all other artemisinin-containing medicines in 2016, we forecast demand for artemisinin to climb to 229 metric tons in 2016. It is expected to remain stable in 2017 and 2018 at 227 and 232 metric tons due to two trends which balance each other out – a forecasted decline in QAACT procurement and a forecasted increase in demand for non-QAACTs. Artemisinin demand is forecast to increase to 242 metric tons in 2019, as QAACT procurement stabilizes while the demand for all other artemisinin containing medicines continues to rise. ACTs comprise 96% of global artemisinin demand, with QAACTs commanding approximately 61% to 73% of global artemisinin demand.

The demand for artemisinin can be influenced by numerous potential events (e.g., reduction in ACT demand with the introduction of ubiquitous, effective case management; increased demand resulting from increased

frequency of delayed parasite clearance in ACT-treated patients that leads to an extension in the duration of therapy). We may explore such scenarios and their impact on RDT, ACT, and artemisinin demand in a future forecast report.

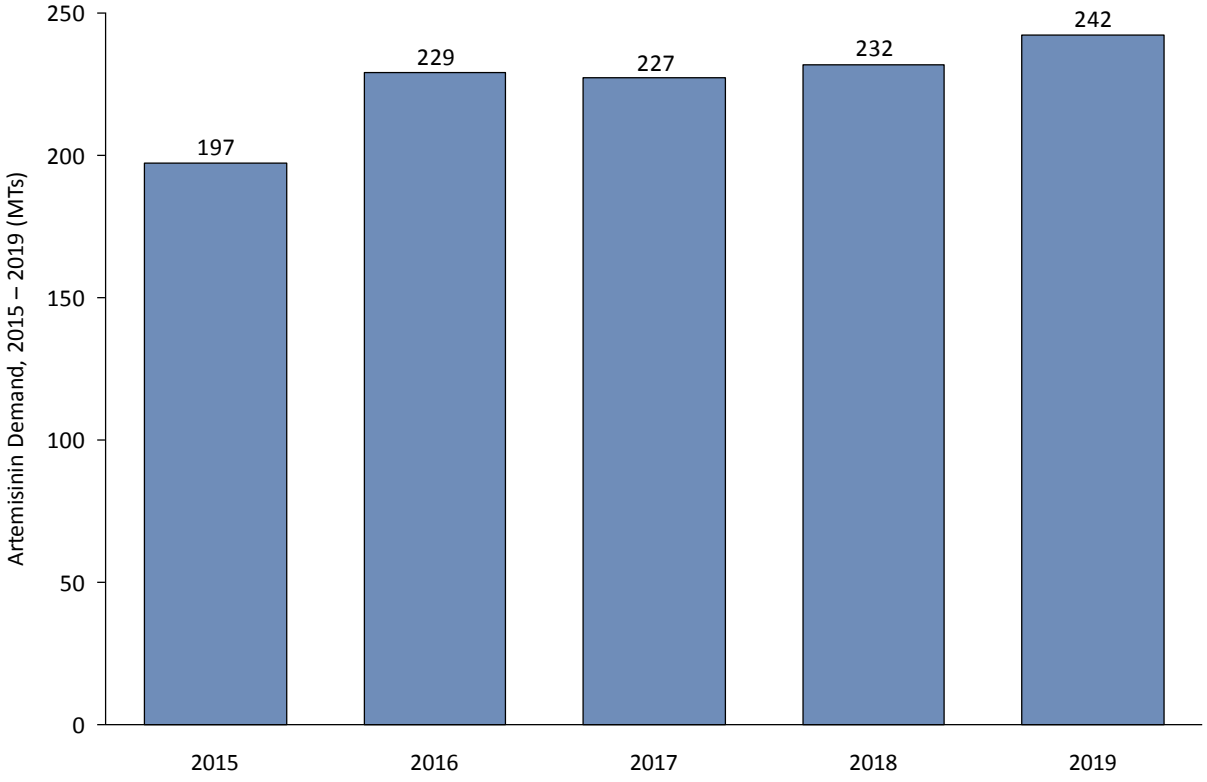


Figure 20 - Artemisinin demand for API, 2015 – 2019 (MTs)

III. EVENTS

In this report, we have used our forecasting models to estimate how specific events/scenarios might affect the ACT/RDT markets. We present analysis around three potentially key events that may occur during the forecast period. An "event" is a future occurrence which will change the expected evolution of given behaviors and acts as a disruption to the baseline forecast. For example, events may include: changes in funding, changes in treatment guidelines, new product launches, new formulation launches or specific disease awareness or education programs. On-going trends, such as improvements to case management in some countries, or decrease in usage of oral artemisinin monotherapies, are not considered as events and are included in the baseline projections.

Predicting the impact of an event is complex and the outputs of this analysis should be used with caution. There is limited historical data to benchmark future shifts in the market, so event impacts have been quantified using best estimates based on available information and judgment. This project's steering committee members have provided input on which events are most critical to model at this point in time, and have provided some guidance on expectations for the impact of the selected events. We have used the steering committee's guidance, along with other available data and qualitative information sources, to provide a consensus view of the impact of each event which has been applied in the model.

The eventing process is iterative by nature and is described previously (INSERT METHODS URL). With guidance from the project's steering committee, we have profiled and provided a number of potential events that could impact artemisinin or RDT demand in the future. Only events affecting demand and procurement have been considered. The steering committee has reviewed these events and has selected three events that they believe may have the greatest impact over the current forecast period:

Events 1 & 2: Change in total donor funding available for ACTs and the total donor funding available for RDTs.

Event 3: Termination of the Private Sector Co-Payment Mechanism (CPM) in countries currently participating in the CPM.

The first two events have been analyzed together in view of their interdependence. The third event will be analyzed separately.

Event 1 & 2: Market impact from a change in total donor funding available for ACTs and total donor funding for RDTs

Event Summary Sheet	
Event Title	Change in total donor funding available for ACTs and total donor funding for RDTs
Event Description	This combined event describes the potential impact of a change in total donor-sponsored funding available for procurement of ACT treatments and RDTs in the public sector.
Baseline	Total donor funding available for ACTs & RDTs follows historical trends
Anticipated Impact	No impact anticipated on global RDT or ACT demand. The GFATM is likely to raise a similar level of funds in its next replenishment cycle and it is not expected that the funding envelope will decrease to such an extent that demand is impacted. In addition, maintaining investment in RDTs and ACTs is a strong priority in most countries so even if there is a slight decrease in the funding envelope it is assumed that demand will remain

	stable and budgets supporting procurement of these diagnostic and treatment commodities will be protected.

This analysis assumes that the event may be influenced in a number of ways, including changes to the global economic environment and GFATM resources, changes in the GFATM priorities or allocations, and impact of national counterpart financing.

Impact of changes in the wider economic environment on the demand and procurement forecasts

GFATM funding comes from a number of sources, with 39 major donors contributing to the 2014 – 2016 fourth replenishment. However, 82% of this budget comes from just 6 donors: the United States, the United Kingdom, France, Germany, Japan, Canada, and the European Community (EC). Therefore, the economic health of these countries may affect future GFATM resources significantly.

The demand forecast should consider the implications of other drivers on national growth in the key countries identified above, given the weight of their contributions to the GFATM budget overall. Several of these countries, notably some in the EC, are currently facing sluggish economic growth. The US economy is growing at a relatively faster rate than most economies in the EC, but the US faces a Presidential election cycle with the next President due to be inaugurated in January 2017. Reflecting uncertainties and weaknesses in the state of the global economy, the International Monetary Fund (IMF) forecast 3.1% global economic growth in 2016 (3). Given the prominent roles of the GFATM and PMI in financing malaria treatment and diagnostic commodities, changes to the political or economic status quo may affect the overall funding for procurement of RDTs and ACTs, and have an add-on effect on demand.

While the current global economic outlook, coupled with extended need for limited funds committed to international development, peace, and health programs, could result in a reduction in funding for malaria programs, we do not anticipate that the global economic climate will adversely affect GFATM or PMI financing the 2017-2019 period

Impact of changes on the GFATM's priorities and allocations on the demand forecast

National and other donor contributions have already been committed for the period 2014 – 2016, for slightly over $12 billion. These funds will be made available to cover the costs of existing grants (covering the requirements for

the ACT and RDT demand forecast until end 2016). Thus, the funds required for the initial period of the forecast are already theoretically guaranteed by the GFATM.

The GFATM is currently engaging in its fifth replenishment process, to guarantee funding for the period 2017 – 2019. This process has already started, and during the December 16-17, 2015 preparatory meeting for the GFATM's fifth replenishment, which was held in Tokyo, Japan, the GFATM announced that it will seek $13 billion in funding commitments to finance programs for 2017 through 2019. The replenishment process will continue with important meetings in February 2016 and a pledge meeting in mid-2016.

Other changes to GFATM funding such as re-focusing of grant allocations between the diseases have also been considered. This has been discussed with the Steering Committee and it is anticipated that malaria funding is likely to remain at 32% of the total allocation. It is less clear how this allocation will be further divided among countries. The GFATM's strategy is shifting to focus increasingly on under-served populations and high risk groups, as well as recognizing the likelihood of several countries (none in Africa at present) transitioning from GFATM funding. This is not expected to have an impact on demand unless funding in the public sector is reduced to such an extent that a given country is unable to procure medicines. We expect that countries will prioritize procurement of WHO-recommended malaria medicines and diagnostics and if faced with funding constraints, would likely reduce non-commodity budgetary spending.

The $13 billion GFATM fifth replenishment, if fulfilled, would be similar to previous replenishment funding levels. There are indications that funding will become available, but formal pledges have not yet been made. The assumption made in this forecast is that funding will remain at approximately the same levels for the period 2017 – 2019. Therefore no decrease in demand is expected as a result of changes to absolute levels in GFATM funding.

Impact of USAID-PMI funding on the demand forecast

In its 2015 – 2020 strategy document, USAID's PMI has committed to accomplish a 40% reduction in malaria morbidity and a 33% reduction in malaria mortality, from 2015 levels, in PMI-supported countries by 2020 (4). USAID's Fiscal Year (FY) 2016 budget includes $674 million for PMI (5), representing a 9% increase in overall funding from the $618M FY2014 budget (6). While it is difficult to predict whether the increase in PMI funding will translate to an increase in RDT/ACT demand or procurement, if there is going to be a reduction in donor funding for RDTs or ACTs, it will not likely be driven by changes to PMI's strategic investment priorities for malaria.

Impact of changes on the National Counterpart financing to the demand forecast

While none of the high burden countries are expected to transition away from GFATM funding for malaria in the forecast timeframe, the influence of national counterpart financing may be important. As part of the GFATM's (new) funding model, countries commit to providing national counterpart financing for tackling the burden of the three main diseases including malaria.

If domestic funds are used for non-commodity costs, this would have no direct implication on ACT/RDT/artemisinin procurement over the period of the grant. Thus there is likely to be no impact on ACT and RDT demand over the forecast period. Should a government fail to meet its contribution requirement, this could have an impact on the grant disbursement overall, thus impacting the funding available for commodity procurement. Given the importance of the GFATM grants for many of the 88 countries in our forecast model, and the increased support provided by the GFATM in continual dialogue with the country principal recipients, this is thought to be low risk.

Conclusion for Events 1 and 2: Market impact from a change in total donor funding available for ACTs and total donor funding for RDTs

Based on the dynamics discussed, no changes to the diagnosis and treatment cascade are expected as a result of this event. The GFATM will request $13 billion in its next replenishment cycle, which is comparable to the funds raised in the fourth replenishment, but which represents a slight decrease from the total $15.8 billion funding allotment (including surplus funds) from that replenishment. The key question is whether a decrease in funding envelope is significant enough to have a sufficient impact on supply at a country level to influence ACT and RDT demand. We assume that it will not have an impact as the overall change in funding is small and maintaining investment in RDTs and ACTs is a strong priority in the countries in our forecast. It is likely that budgets for procurement of ACTs and RDTs will be protected even if there is a decrease in the funding envelope, and thus neither demand for ACTs and RDTs will diminish, nor will procurement.

Event 3: Termination of the Private Sector Co-Payment Mechanism (CPM) in countries currently participating in the CPM.

Event Summary Sheet	
Event Title	Termination of the Private Sector Co-Payment Mechanism (CPM) in countries currently participating in the CPM.

Event Description	Cessation of funding allocation, initiated at the country level in GFATM concept notes, for continued investment in a Private Sector Co-payment Mechanism (CPM), with programs eliminated after the current funding cycle.
Baseline	Countries continue to fund the CPM as outlined in current or imminent GFATM grants
Anticipated Impact	• Decrease in ACT demand in the private sector • Increase in proportion of non-QAACTs demand in the private sector • Decreased QAACT procurement in the private sector • Number of cases of severe malaria may increase, increase in fever cases and malaria prevalence

The CPM follows on directly from the AMFm and continues to focus on providing a subsidy, provided directly to manufacturers, for recommended ACT products purchased by importers qualified as part of the CPM.

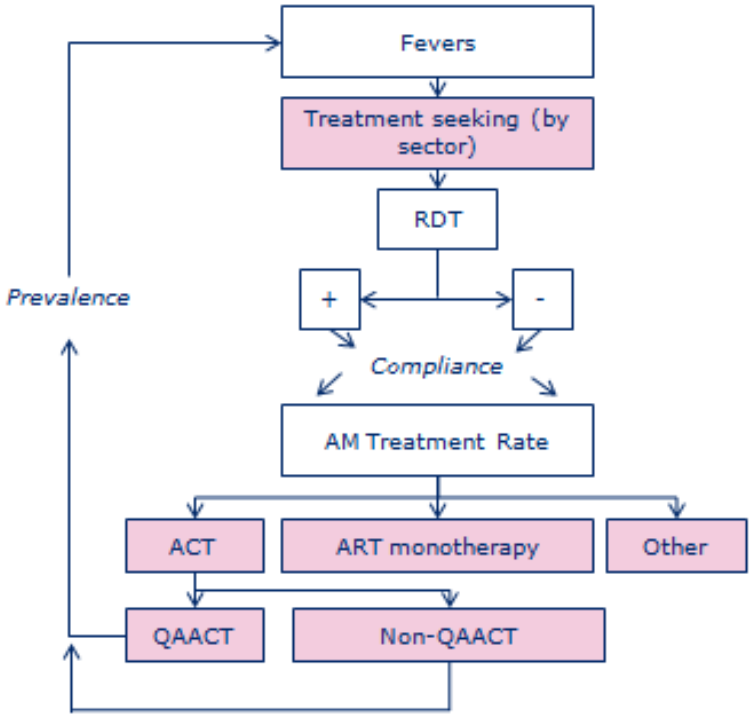
The analysis of this event will focus on five of the original eight AMFm countries which have continued the CPM process through 2016, phased into their current GFATM grants (Ghana, Kenya, Tanzania, Nigeria, and Uganda). Three of the original countries (Cambodia, Madagascar, and Zanzibar) are not among the top 20 burden countries so the impact of removing the CPM will not be modeled for these countries.

If the CPM is terminated in Ghana, Kenya, Tanzania, Nigeria, and Uganda, then the subsequent change in affordability and availability of QAACTs is likely to affect treatment demand. Price differentials between anti-malarial products can be significant: in the latest WHO/Health Action International (HAI) survey, the cost of a pediatric treatment course ranged from $0.23 to $0.70 in formal outlets in Ghana and $0.58 to $0.97 (for the ACTm-branded QAACT product) in informal outlets in Uganda, while the median price for sulfadoxine pyrimethamine in the formal sector in Nigeria was $0.43 and the median price for ACTm artemether-lumefantrine in the same sector was $2.17 per treatment course. As countries move beyond their current commitments (2016 or 2017) to support the CPM, price differentials between anti-malarial products and those for identical products sold across different channels may have a critical impact on the ability of domestically funded CPMs to achieve their targets for the affordability, availability, and appropriate use of QAACTs.

As historical ACT sales data have shown, the AMFm resulted in a significant increase in QAACT volumes in the initial pilot countries. While the market has stabilized, in part due to volume controls resulting from funding limitations, there is still a large volume of product passing through this mechanism and thus affecting overall demand.

Parts of diagnosis & treatment cascade impacted

The key points likely to be affected by a change in this event are:



1. Treatment seeking by sector should QAACTs become significantly more / less available in one sector than another
2. The choice of product (ACT, monotherapy, other) based on what is available or preferred
3. The use of a QAACT versus a non-QAACT based on availability and price

As the private sector is not currently systematically using RDT or microscopy to diagnose malaria, we assume that treatment is often provided presumptively even if there are measures to increase the frequency of diagnosis before treatment. Thus, we assume that the consumption of RDTs is unlikely to be affected significantly in 2016 – 2017, but may change from 2018 if countries focus on achieving broad compliance with the diagnostics guidelines across all distribution channels.

Similarly, many national malaria control strategic plans consider prevalence rates to be significantly influenced by (1) better diagnosis, (2) improved reporting on malaria cases and (3) scale up in preventive measures (long lasting

insecticidal nets) or, inversely, decreases in prevention (e.g. due to decreased LLIN coverage rates and/or insecticide resistance). We therefore believe that a change in the CPM is unlikely to be the most significant driver in national prevalence data.

We have modeled the event's impact as starting in 2017 for all countries except Tanzania which has CPM funding until 2018 (Table 1). The peak impact is reached after two years and we have modeled time to impact as a linear impact, thus if the time to impact is 2 years then 50% of the impact is reached at the end of year 1 and 100% of the impact is reached after two years. These assumptions are in-line with a typical generic erosion curve where peak impact is reached after two years.

Country	Event start date	Time to impact
Ghana	2017	2 years
Kenya	2017	2 years
Nigeria	2017	2 years
Tanzania	2018	2 years
Uganda	2017	2 years

Table 1 - Summary of countries affected by event, event start date and time to impact

Table 2, below, highlights how the event will affect the demand forecast baseline. For each event impact, the key point in the baseline forecast that is affected, and the quantification of the impact, is provided.

Event impact	Key impact point	Quantification of impact
1.Treatment seeking by sector (should ACTs become significantly more / less available in one sector than	Treatment seeking private formal	We have assumed that there will be a reduction in treatment seekers in the private sector and an increase in treatment seekers in the public sector as subsidized QAACTs become less available or less

another)	Treatment seeking private informal	affordable in the private sector. We have assumed that this corresponds to a **10% decrease** in treatment seekers in the private formal and informal sectors with a **corresponding increase** in treatment seekers in the public sector
	Treatment seeking public	
2.The choice of product (ACT, monotherapy, other) based on what is available	Treatment with artemisinin in the private informal channel	We have assumed that a proportion of treatment seekers in the private informal sector would shift to lower cost anti-malarials (not ACTs) as the CPM is removed. We used IMS data to compare the usage of oral artemisinin to other anti-malarial products in the private sector in CPM and non-CPM countries. As expected, usage of oral artemisinin is higher in CPM countries vs. non-CPM countries. On withdrawal of the CPM, we have assumed a **12.5% decrease** in oral artemisinin usage in the private informal sector. This decrease brings the % of artemisinin usage in line with the higher range for non-AMFm countries.
3.The use of a QAACT versus a non-QAACT based on availability and price	Treatment with QAACT in private informal sector	We have assumed that there will be a **decrease in usage of QAACTs** in the private channels as CPM is withdrawn. For the private informal sector, we have assumed that usage of QAACTs decreases to match levels observed in non-CPM countries. In non-CPM countries, QAACT demand typically makes up approximately 23% of total ACT demand in the private sector. A corresponding increase in demand for non-QAACTs is assumed. We expect there to be less switching from QAACTs to non-QAACTS in the private formal sector and demand for QAACTs is expected to remain higher than the average level observed for non-CPM countries. Therefore we have assumed that QAACTs will contribute to 33% of total ACT demand in the private formal sector. This is an estimate as there is no reliable data available to predict how consumer behavior might change with regard to treatment seeking and treatment in the two private sectors. A corresponding increase in demand for non-QAACT is also assumed in the private formal channel.
	Treatment with non-QAACT in private informal sector	
	Treatment with QAACT in private formal sector	
	Treatment with non-QAACT in private formal sector	

Table 2 - Summary of event effects by level impacted and quantified impact

Impact on QAACT Demand

As previously discussed, termination of the CPM is forecast to have affect ACT demand in Ghana, Kenya, Nigeria, Tanzania and Uganda. All other countries maintain the same ACT demand as specified in the baseline. Out of the five countries that are impacted by this event, Nigeria has the largest baseline ACT demand and correspondingly is forecast to have the largest net change in QAACT demand after event 3 is applied (Table 3).

	Absolute demand for QAACTs with event 3 applied						Net change in QAACT demand from baseline		
	2017		2018		2019		2017	2018	2019
Country	Public	Private	Public	Private	Public	Private	All channels		
Ghana	11,850,036	2,444,619	13,115,603	1,299,808	13,981,843	1,417,673	-1,089,805	-2,139,696	-2,355,042
Kenya	12,400,342	2,288,628	14,011,462	1,273,293	15,251,585	1,426,017	-971,524	-1,973,804	-2,239,152
Nigeria	29,672,963	16,407,633	36,641,407	9,286,865	41,690,720	10,707,200	-8,031,186	-16,900,698	-19,542,540
Tanzania	21,040,322	6,326,937	23,258,718	4,279,038	25,612,653	2,256,655	0	-2,086,324	-4,076,195
Uganda	25,130,430	7,362,123	28,110,069	3,980,655	30,004,916	4,334,930	-3,401,150	-6,699,374	-7,342,921

Table 3 - Event #3: Termination of CPM in 2016/2017. Absolute QAACT demand 2017-2019 in Ghana, Kenya, Nigeria, Tanzania and Uganda

Comparing the evented global ACT demand forecast to the baseline (Figure 21) shows that termination of CPM leads to a <1% decrease in total ACT demand in 2019. This decrease is due to a greater number of treatment seekers switching to cheaper, non-artemisinin, anti-malarial medicines, as compared to treatment seekers who switch to get treatment from the public sector.

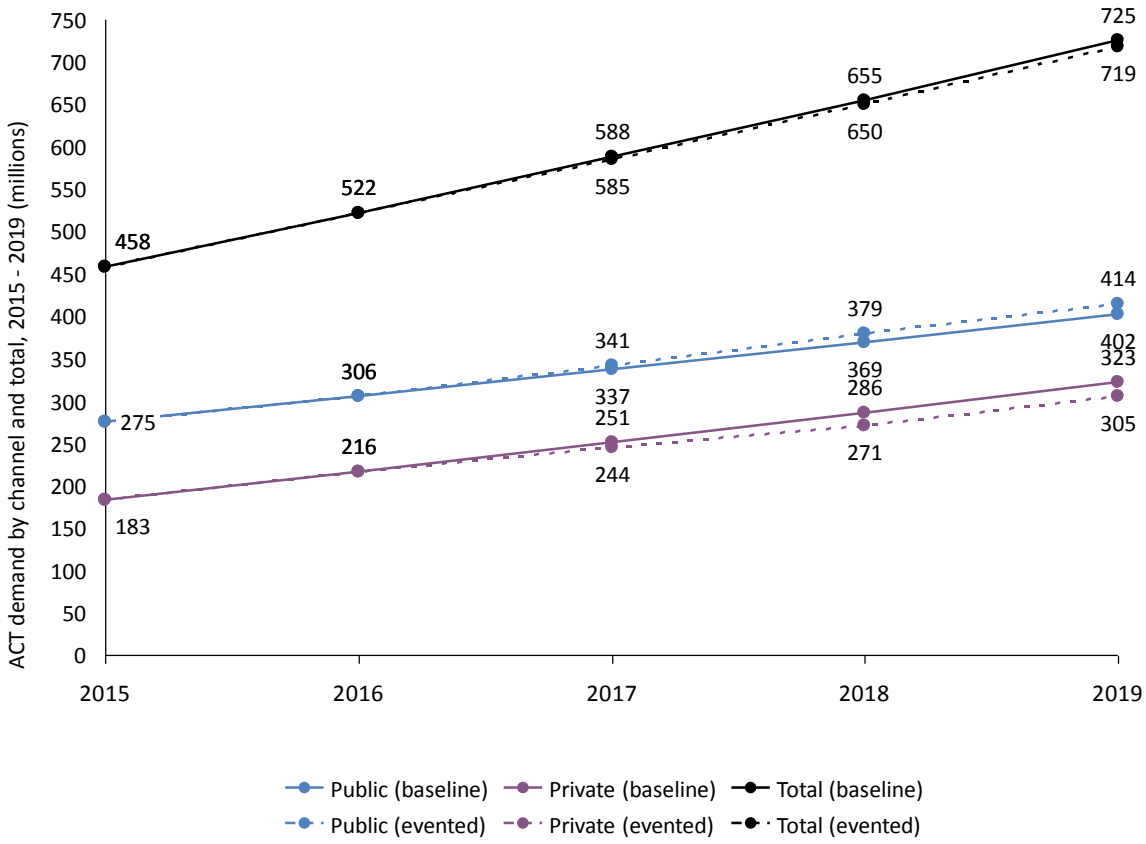


Figure 21 -- ACT demand by channel and total, 2015 – 2019, for baseline and evented forecast

The impact is more pronounced if the evented global QAACT demand forecast is compared to the baseline forecast (Figure22). From 2017 onwards, due to changes in the availability and affordability of QAACTs in the private sector, there is a decrease in QAACT demand in the private sector and an increase in QAACT demand in the public sector, resulting in a 6% decrease in total QAACT demand relative to the baseline forecast in 2019.

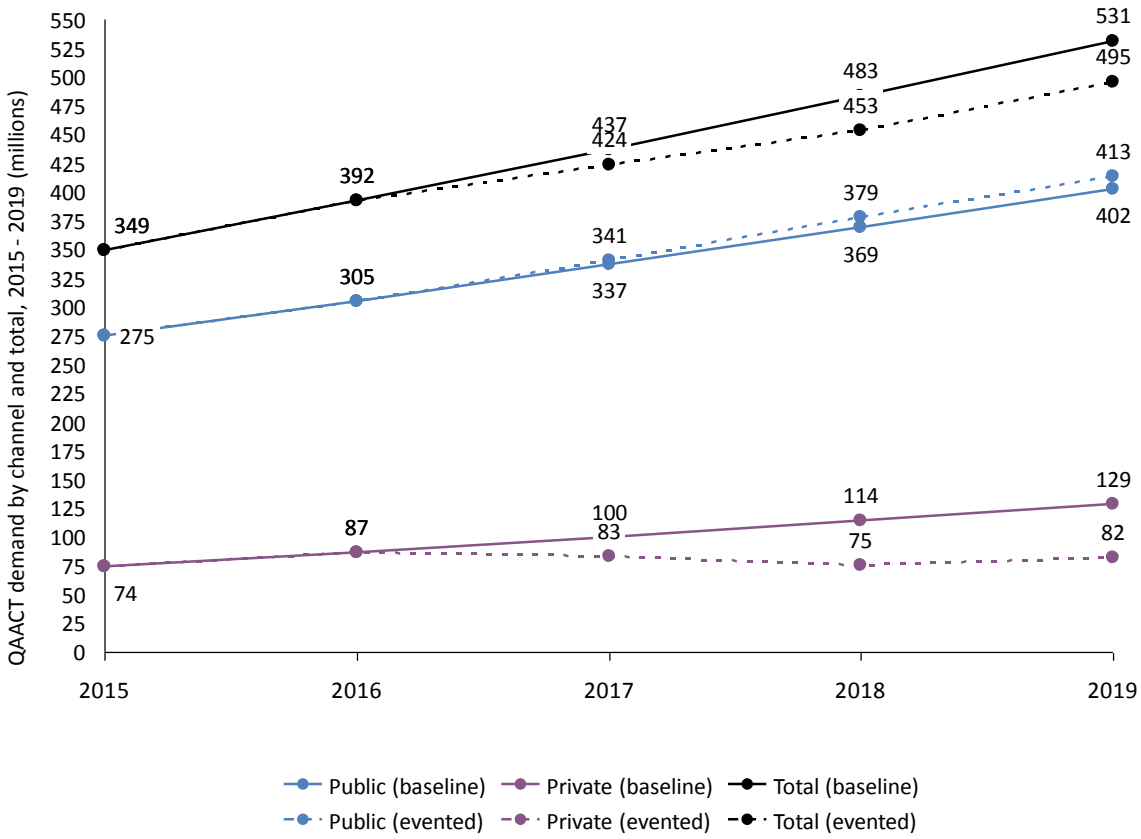


Figure 22 -- QAACT demand by channel and total, 2015 – 2019, for baseline and evented forecast

This decrease in QAACT demand compared to the baseline is driven by a drop in demand for artemether lumefantrine, which is forecast to decrease from 355 million treatments in the baseline to 324 million treatments in 2019 (Figure 23). A small decrease in ASAQ demand of 4 million treatments vs. the baseline is also projected.

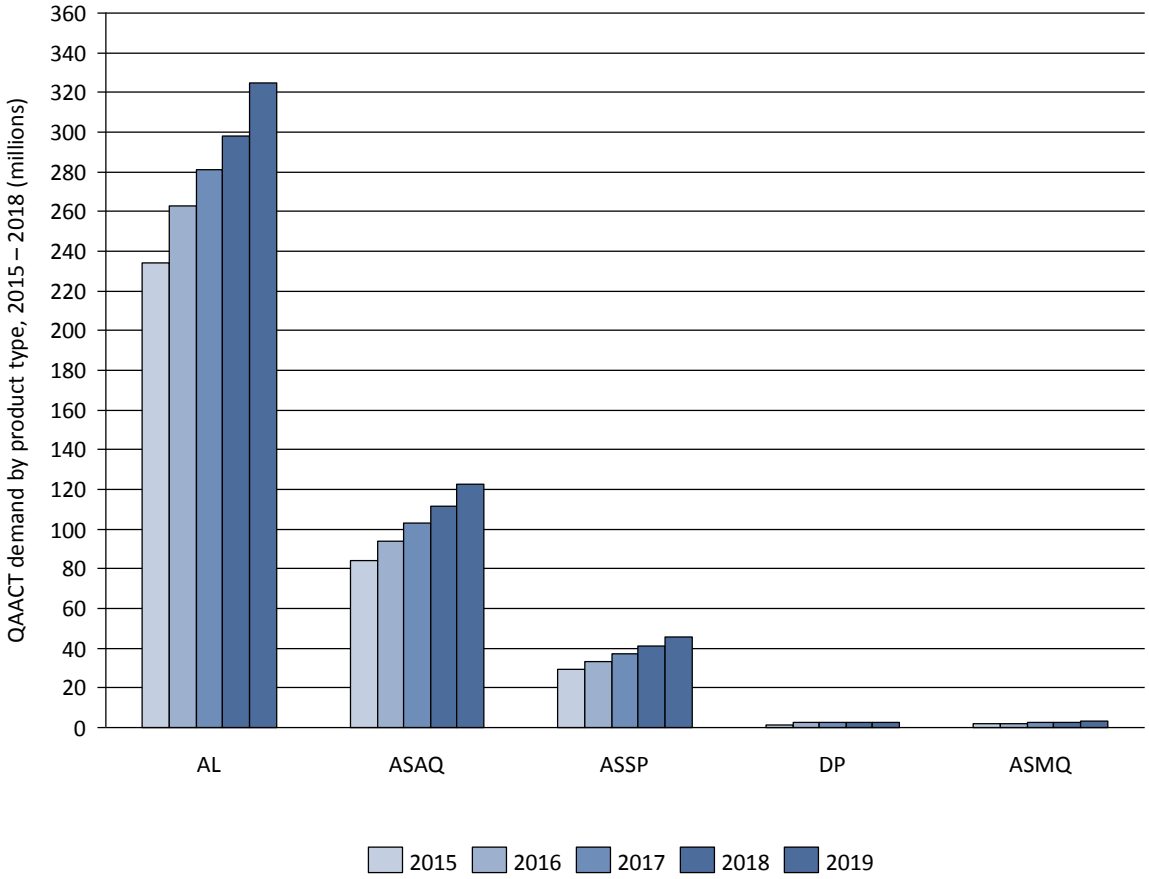


Figure 23 -- QAACT global demand, by product type, 2015 - 2019 for evented forecast (millions)

Impact on QAACT Procurement

Given that the CPM comprised an estimated 36%- 40% of QAACT procurement in 2015, and is expected to command 19-20% of all QAACT procurement in 2016, termination of the CPM, as modeled in this event, is likely to have a dramatic effect on QAACT procurement. Similar to the approach outlined above, we assumed that some 10% of treatment seekers would shift from the private sector to the public sector. We expect that this will result in a small increase in QAACT procurement by the public sector. However, this small increase pales in comparison to the rapid erosion of the QAACTs in the private sector. While the forecast estimates an overall peak in QAACT procurement in 2016 followed by a shallow decline leading to 2019, termination of the CPM might push global QAACT volumes back to pre-2012 level volumes, falling to 323 million in 2019 (Figure 24). Although QAACT procurement in the private sector would decline under such an event, we expect that some or many outlets in the private formal sector would maintain of the use of QAACTs in preference over the use of non-QAACTs.

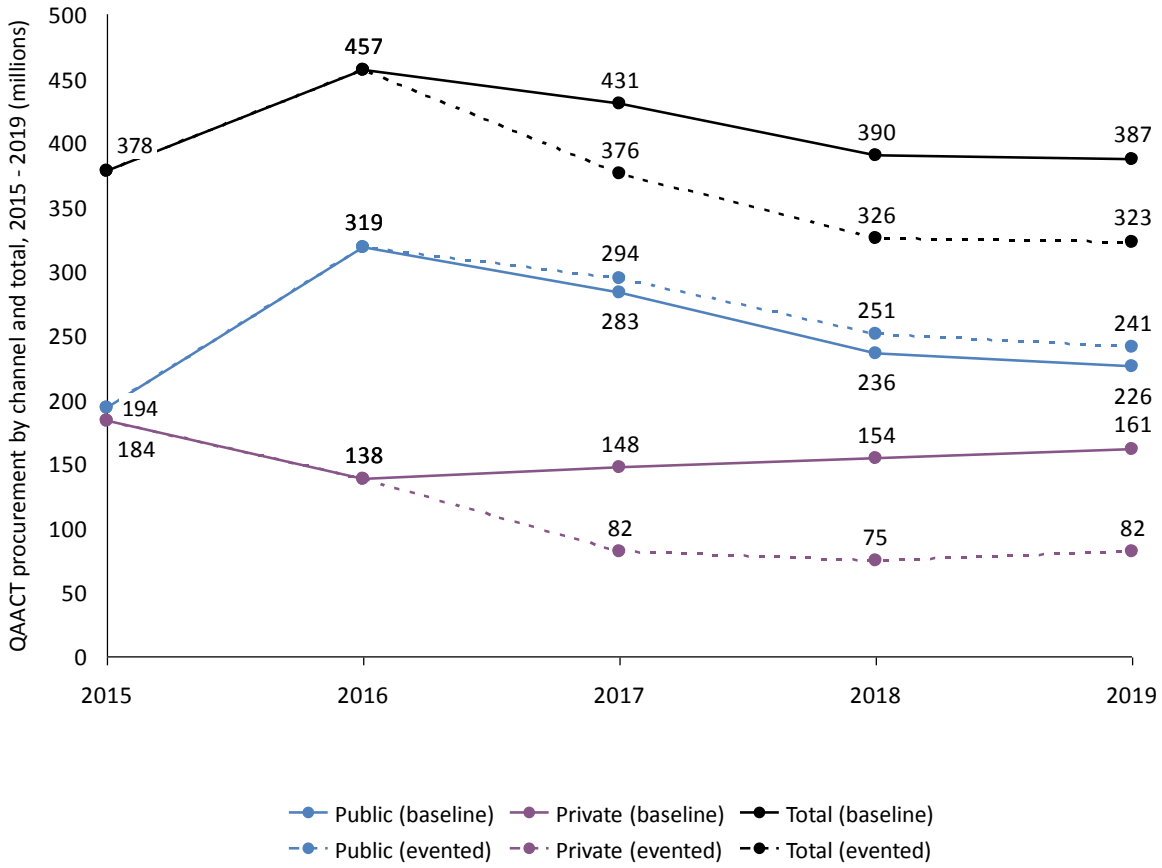


Figure 24 – Event #3: Cessation of CPM in 2016/17. QAACT Procurement by channel and total, 2015 - 2019 (millions)

Conclusion for Event 3: Impact of Termination of Private Sector Co-Payment Mechanism

The private sector co-payment mechanism has had a dramatic effect on the affordability and availability of QAACTs in countries that were initial AMFm pilot countries. This program significantly boosted the annual global volumes of QAACTs sold. Given the five years of exposure to ACTm's, it is not surprising that termination of the CPM would have only a minor effect on overall ACT demand, and would induce the reverse effect on QAACT procurement: a retreat to pre-2012 volumes (mostly public sector). These changes would be driven by private channel treatment seekers who can no longer afford QAACTs and switch to treatment with other ACTs or anti-malarials.

IV. DISCUSSION

We have presented a comprehensive global forecast for demand and procurement for malaria rapid diagnostic tests, need, demand, and procurement for artemisinin-based malaria treatments, and artemisinin API demand. The model we have built is dynamic and allows for further exploration of the interactions between these commodities as global demand and procurement volumes shift, and we will continue to publish revised forecasts each calendar quarter that will enable improved projections based on additional data that will be collected on an ongoing basis.

As the data presented in this report are considered, it is important to keep in mind some of the caveats and weakness around our forecast models and forecasting in general. Each of the models used to project our forecasts do so through extrapolation of historical trends. They use periodical, historical data to project future demand for tests, anti-malarials, and ACTs, and as such rely on trend analysis that in some instances may not accurately project rapid changes introduced into the market with the uptake of new initiatives or priorities. The forecasts presented here are our best guess, based on the data currently available to us, of what will transpire in the global malaria diagnostics and treatment space through 2019.

V. APPENDIX A: DATA TABLES

Table 4 - List of Countries by WHO Region

Region	Country
Africa	Angola
	Benin
	Botswana
	Burkina Faso
	Burundi
	Cameroon
	Central African Republic
	Chad
	Comoros
	Congo
	Côte d'Ivoire
	Democratic Republic of the Congo
	Equatorial Guinea
	Eritrea
	Ethiopia
	Gabon
	Gambia
	Ghana
	Guinea

	Guinea-Bissau Kenya Liberia Madagascar Malawi Mali Mauritania Mozambique Namibia Niger Nigeria Rwanda Sao Tome and Principe Senegal Sierra Leone Swaziland Tanzania Togo Uganda Zambia Zimbabwe
Americas	Belize Bolivia Brazil Colombia Costa Rica Dominican Republic Ecuador French Guiana Guatemala Guyana Haiti Honduras Mexico Nicaragua Panama Peru Suriname Venezuela
Eastern Mediterranean	Afghanistan Djibouti Iran Oman Pakistan Saudi Arabia Somalia South Sudan Sudan Yemen
Europe	Tajikistan

	Turkmenistan
South-East Asia	Bangladesh Bhutan India Indonesia Myanmar Nepal Thailand Timor-Leste
Western Pacific	Australia Brunei Darussalam Cambodia China Lao PDR Malaysia Papua New Guinea Philippines Solomon Islands Vanuatu Vietnam

Table 5 - Incident Fevers among malaria-at-risk populations, by geographical region, 2015 - 2019

Region	2015	2016	2017	2018	2019
Africa	3,679,621,800	3,778,605,200	3,878,434,500	3,979,372,900	4,081,768,300
Americas	654,850,000	662,736,400	670,490,700	678,120,700	685,648,500
Eastern Mediterranean	1,674,104,900	1,704,474,200	1,735,101,200	1,765,929,500	1,796,823,700
Europe	20,305,800	20,717,200	21,120,600	21,516,500	21,906,200
South-East Asia	6,546,463,800	6,616,967,000	6,685,139,800	6,751,349,100	6,816,340,600
Western Pacific	1,081,356,500	1,093,871,300	1,106,050,000	1,117,907,200	1,129,506,700
TOTAL	**13,656,702,900**	**13,877,371,300**	**14,096,336,900**	**14,314,195,800**	**14,531,993,900**

Table 6 - ACT Need (Incident fevers with likely malaria infection, among malaria-at-risk populations), by geographical region, 2015 - 2019

Region	2015	2016	2017	2018	2019
Africa	1,098,770,000	1,127,861,300	1,156,741,900	1,185,618,000	1,214,773,000
Americas	6,836,500	6,907,100	6,974,600	7,039,500	7,103,000
Eastern Mediterranean	35,493,700	36,243,400	36,982,000	37,713,400	38,441,400
Europe	300	300	300	300	300
South-East Asia	207,558,400	209,408,600	211,072,400	212,590,000	214,048,600
Western Pacific	18,652,100	18,934,800	19,203,100	19,459,900	19,713,000
TOTAL	**1,367,310,900**	**1,399,355,500**	**1,430,974,400**	**1,462,421,100**	**1,494,079,300**

Table 7 - ACT Demand by Channel, by Region, 2015 – 2019 (Baseline)

Channel	Region	2015	2016	2017	2018	2019
Public	Africa	234,543,900	259,429,600	285,102,800	311,437,500	338,535,300
	Americas	922,300	1,274,600	1,634,000	2,000,200	2,373,100
	Eastern Mediterranean	19,812,500	22,252,800	24,775,700	27,383,800	30,080,500
	Europe	26,900	31,400	36,100	40,900	45,800
	South-East Asia	18,125,300	20,766,100	23,437,300	26,138,700	28,876,700
	Western Pacific	1,607,100	1,846,100	2,089,100	2,336,100	2,587,300
	Public Total	275,037,900	305,600,600	337,075,000	369,337,100	402,498,700
Private Formal	Africa	31,763,600	36,811,600	42,081,800	47,582,300	53,314,500
	Americas	206,600	278,600	352,200	427,200	503,800
	Eastern Mediterranean	7,722,200	9,545,900	11,428,000	13,370,100	15,370,800
	Europe	6,500	8,400	10,300	12,300	14,400
	South-East Asia	36,351,300	44,536,600	52,846,700	61,274,400	69,830,900
	Western Pacific	534,600	645,500	758,200	872,600	988,500
	Private Formal Total	76,585,000	91,826,600	107,477,200	123,539,000	140,022,900
Private Informal	Africa	85,223,200	98,800,000	112,977,500	127,774,700	143,196,600
	Americas	250,000	338,500	429,000	521,400	615,700
	Eastern Mediterranean	8,049,300	9,528,800	11,062,900	12,652,400	14,298,100
	Europe	9,400	12,100	14,900	17,800	20,700
	South-East Asia	12,017,500	14,737,000	17,510,200	20,335,700	23,212,500
	Western Pacific	759,100	893,400	1,030,600	1,170,500	1,313,000
	Private Formal Total	106,308,500	124,309,800	143,025,000	162,472,500	182,656,700
Total *(across channels)*	Africa	351,530,800	395,041,100	440,162,100	486,794,500	535,046,400
	Americas	1,379,000	1,891,700	2,415,100	2,948,800	3,492,600
	Eastern Mediterranean	35,583,900	41,327,500	47,266,600	53,406,300	59,749,400
	Europe	42,800	52,000	61,300	71,000	80,900
	South-East Asia	66,494,100	80,039,600	93,794,100	107,748,800	121,920,100
	Western Pacific	2,900,800	3,385,100	3,877,900	4,379,100	4,888,800
Grand Total		457,931,400	521,736,900	587,577,200	655,348,500	725,178,200

Table 8 - QAACT demand by channel, by region, by ACT type, 2015 - 2019 (Baseline - Lower bound)

Channel	Region	ACT Type	2015	2016	2017	2018	2019
Public	**Africa**	AL	165,898,297	182,972,996	200,563,687	218,530,872	236,981,187
		ASAQ	68,645,589	76,456,606	84,539,141	92,906,618	101,554,071
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Africa	***234,543,886***	***259,429,602***	***285,102,828***	***311,437,491***	***338,535,258***
	Americas	AL	196,664	269,950	344,080	418,923	494,492
		ASAQ	303	416	529	643	758
		ASSP	84,485	117,209	150,750	185,092	220,225

		DP	-	-	-	-	-
		ASMQ	640,893	887,005	1,138,616	1,395,521	1,657,671
		Americas	***922,344***	***1,274,580***	***1,633,974***	***2,000,179***	***2,373,146***
	Eastern Mediterranean	AL	1,214,705	1,404,157	1,600,838	1,804,961	2,016,539
		ASAQ	4,630,531	5,089,436	5,550,919	6,016,324	6,491,781
		ASSP	13,967,214	15,759,174	17,623,917	19,562,472	21,572,181
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Eastern Mediterranean	***19,812,450***	***22,252,767***	***24,775,675***	***27,383,757***	***30,080,501***
	Europe	AL	18,654	21,846	25,130	28,506	31,977
		ASAQ	-	-	-	-	-
		ASSP	8,214	9,577	10,962	12,367	13,792
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Europe	***26,868***	***31,423***	***36,093***	***40,873***	***45,769***
	South-East Asia	AL	931,533	1,109,078	1,289,100	1,471,466	1,656,010
		ASAQ	1,656,313	1,914,552	2,178,920	2,449,288	2,724,414
		ASSP	14,674,179	16,785,563	18,918,825	21,074,102	23,259,251
		DP	-	-	-	-	-
		ASMQ	863,405	957,055	1,050,637	1,144,041	1,237,277
		South-East Asia	***18,125,430***	***20,766,248***	***23,437,482***	***26,138,897***	***28,876,952***
	Western Pacific	AL	968,301	1,111,283	1,257,642	1,407,318	1,560,420
		ASAQ	295,498	336,984	378,662	420,473	462,385
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	218,762	241,658	264,602	287,648	311,055
		Western Pacific	***1,482,561***	***1,689,925***	***1,900,905***	***2,115,438***	***2,333,861***
	Public Total *(all regions)*	AL	***169,228,155***	***186,889,310***	***205,080,478***	***223,662,046***	***242,740,626***
		ASAQ	***75,228,234***	***83,797,994***	***92,648,171***	***101,793,346***	***111,233,410***
		ASSP	***28,734,091***	***32,671,523***	***36,704,455***	***40,834,032***	***45,065,449***
		DP	-	-	-	-	-
		ASMQ	***1,723,059***	***2,085,718***	***2,453,854***	***2,827,210***	***3,206,003***
	Public Total		***274,913,540***	***305,444,545***	***336,886,958***	***369,116,635***	***402,245,489***
Private	**Africa**	AL	48,001,158	55,721,872	63,807,908	72,252,856	81,049,855
		ASAQ	8,352,865	9,786,847	11,305,516	12,885,921	14,529,275
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Africa	***56,354,023***	***65,508,719***	***75,113,425***	***85,138,777***	***95,579,130***
	Americas	AL	100,503	135,423	171,810	208,836	246,428

		ASAQ	6,027	8,099	10,266	12,480	14,736
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Americas	***106,530***	***143,522***	***182,076***	***221,316***	***261,165***
	Eastern Mediterranean	AL	1,896,415	2,179,919	2,487,278	2,804,951	3,132,569
		ASAQ	499,104	569,122	644,232	720,892	799,488
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Eastern Mediterranean	***2,395,519***	***2,749,041***	***3,131,510***	***3,525,843***	***3,932,057***
	Europe	AL	3,628	4,650	5,732	6,843	7,981
		ASAQ	96	124	153	182	211
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Europe	***3,724***	***4,774***	***5,884***	***7,025***	***8,193***
	South-East Asia	AL	14,458,295	17,712,694	21,021,767	24,381,315	27,794,333
		ASAQ	7,522	8,615	9,754	10,883	12,003
		ASSP	291,366	356,906	423,515	491,139	559,849
		DP	-	-	-	-	-
		ASMQ	6,386	7,822	9,282	10,764	12,270
		South-East Asia	***14,763,570***	***18,086,037***	***21,464,318***	***24,894,102***	***28,378,455***
	Western Pacific	AL	251,648	291,840	334,227	377,380	421,321
		ASAQ	10,501	11,941	13,456	14,982	16,522
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Western Pacific	***262,149***	***303,781***	***347,683***	***392,362***	***437,843***
	Private Total *(all regions)*	AL	***64,711,648***	***76,046,398***	***87,828,722***	***100,032,180***	***112,652,487***
		ASAQ	***8,876,115***	***10,384,749***	***11,983,378***	***13,645,341***	***15,372,236***
		ASSP	***291,366***	***356,906***	***423,515***	***491,139***	***559,849***
		DP	-	-	-	-	-
		ASMQ	***6,386***	***7,822***	***9,282***	***10,764***	***12,270***
	Private Total		***73,885,515***	***86,795,875***	***100,244,897***	***114,179,425***	***128,596,843***
TOTAL (across channels)	**Africa**	AL	213,899,456	238,694,868	264,371,596	290,783,728	318,031,042
		ASAQ	76,998,454	86,243,453	95,844,657	105,792,539	116,083,346
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-

		Africa	***290,897,909***	***324,938,321***	***360,216,253***	***396,576,268***	***434,114,389***
	Americas	AL	297,167	405,373	515,890	627,759	740,921
		ASAQ	6,330	8,515	10,795	13,123	15,494
		ASSP	84,485	117,209	150,750	185,092	220,225
		DP	-	-	-	-	-
		ASMQ	640,893	887,005	1,138,616	1,395,521	1,657,671
		Americas	***1,028,874***	***1,418,102***	***1,816,051***	***2,221,495***	***2,634,311***
	Eastern Mediterranean	AL	3,111,121	3,584,076	4,088,116	4,609,912	5,149,107
		ASAQ	5,129,635	5,658,558	6,195,152	6,737,216	7,291,270
		ASSP	13,967,214	15,759,174	17,623,917	19,562,472	21,572,181
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Eastern Mediterranean	***22,207,970***	***25,001,808***	***27,907,185***	***30,909,599***	***34,012,558***
	Europe	AL	22,282	26,496	30,862	35,349	39,959
		ASAQ	96	124	153	182	211
		ASSP	8,214	9,577	10,962	12,367	13,792
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Europe	***30,592***	***36,197***	***41,977***	***47,898***	***53,962***
	South-East Asia	AL	15,389,828	18,821,772	22,310,867	25,852,781	29,450,343
		ASAQ	1,663,835	1,923,168	2,188,674	2,460,172	2,736,417
		ASSP	14,965,545	17,142,469	19,342,340	21,565,241	23,819,100
		DP	-	-	-	-	-
		ASMQ	869,791	964,877	1,059,919	1,154,805	1,249,547
		South-East Asia	***32,889,000***	***38,852,286***	***44,901,800***	***51,032,999***	***57,255,407***
	Western Pacific	AL	1,219,949	1,403,123	1,591,869	1,784,698	1,981,741
		ASAQ	305,999	348,925	392,118	435,455	478,908
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	218,762	241,658	264,602	287,648	311,055
		Western Pacific	***1,744,710***	***1,993,706***	***2,248,588***	***2,507,801***	***2,771,704***
	Total *(all regions)*	AL	***233,939,803***	***262,935,709***	***292,909,200***	***323,694,226***	***355,393,113***
		ASAQ	***84,104,350***	***94,182,742***	***104,631,549***	***115,438,687***	***126,605,646***
		ASSP	***29,025,457***	***33,028,429***	***37,127,969***	***41,325,172***	***45,625,299***
		DP	-	-	-	-	-
		ASMQ	***1,729,445***	***2,093,540***	***2,463,136***	***2,837,974***	***3,218,273***
GRAND TOTAL			***348,799,055***	***392,240,420***	***437,131,854***	***483,296,059***	***530,842,331***

Table 9 - QAACT demand by channel, by region, by ACT type, 2015 - 2019 (Baseline - Upper bound)

Channel	Region	ACT Type	2015	2016	2017	2018	2019
Public	**Africa**	AL	165,898,297	182,972,996	200,563,687	218,530,872	236,981,187
		ASAQ	68,645,589	76,456,606	84,539,141	92,906,618	101,554,071
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Africa	***234,543,886***	***259,429,602***	***285,102,828***	***311,437,491***	***338,535,258***
	Americas	AL	196,664	269,950	344,080	418,923	494,492
		ASAQ	303	416	529	643	758
		ASSP	84,485	117,209	150,750	185,092	220,225
		DP	-	-	-	-	-
		ASMQ	640,893	887,005	1,138,616	1,395,521	1,657,671
		Americas	***922,344***	***1,274,580***	***1,633,974***	***2,000,179***	***2,373,146***
	Eastern Mediterranean	AL	1,214,705	1,404,157	1,600,838	1,804,961	2,016,539
		ASAQ	4,630,531	5,089,436	5,550,919	6,016,324	6,491,781
		ASSP	13,967,214	15,759,174	17,623,917	19,562,472	21,572,181
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Eastern Mediterranean	***19,812,450***	***22,252,767***	***24,775,675***	***27,383,757***	***30,080,501***
	Europe	AL	18,654	21,846	25,130	28,506	31,977
		ASAQ	-	-	-	-	-
		ASSP	8,214	9,577	10,962	12,367	13,792
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Europe	***26,868***	***31,423***	***36,093***	***40,873***	***45,769***
	South-East Asia	AL	931,533	1,109,078	1,289,100	1,471,466	1,656,010
		ASAQ	1,656,313	1,914,552	2,178,920	2,449,288	2,724,414
		ASSP	14,674,179	16,785,563	18,918,825	21,074,102	23,259,251
		DP	-	-	-	-	-
		ASMQ	863,405	957,055	1,050,637	1,144,041	1,237,277
		South-East Asia	***18,125,430***	***20,766,248***	***23,437,482***	***26,138,897***	***28,876,952***
	Western Pacific	AL	968,301	1,111,283	1,257,642	1,407,318	1,560,420
		ASAQ	295,498	336,984	378,662	420,473	462,385
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	218,762	241,658	264,602	287,648	311,055
		Western Pacific	***1,482,561***	***1,689,925***	***1,900,905***	***2,115,438***	***2,333,861***
	Public Total *(all regions)*	AL	***169,228,155***	***186,889,310***	***205,080,478***	***223,662,046***	***242,740,626***
		ASAQ	***75,228,234***	***83,797,994***	***92,648,171***	***101,793,346***	***111,233,410***
		ASSP	***28,734,091***	***32,671,523***	***36,704,455***	***40,834,032***	***45,065,449***
		DP	-	-	-	-	-
		ASMQ	***1,723,059***	***2,085,718***	***2,453,854***	***2,827,210***	***3,206,003***
	Public Total		***274,913,540***	***305,444,545***	***336,886,958***	***369,116,635***	***402,245,489***

Private	**Africa**	AL	55,364,733	64,185,978	73,414,048	83,050,275	93,086,502
		ASAQ	11,140,313	13,058,588	15,076,575	17,177,701	19,364,210
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Africa	***66,505,046***	***77,244,565***	***88,490,623***	***100,227,976***	***112,450,712***
	Americas	AL	203,466	274,666	347,887	422,506	498,464
		ASAQ	12,607	16,962	21,456	26,052	30,747
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Americas	***216,072***	***291,628***	***369,342***	***448,558***	***529,211***
	Eastern Mediterranean	AL	6,537,652	8,032,390	9,585,320	11,187,827	12,838,299
		ASAQ	871,109	996,031	1,126,748	1,260,615	1,398,340
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Eastern Mediterranean	***7,408,761***	***9,028,421***	***10,712,068***	***12,448,442***	***14,236,639***
	Europe	AL	7,021	9,027	11,116	13,266	15,475
		ASAQ	166	214	263	314	365
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Europe	***7,187***	***9,240***	***11,379***	***13,580***	***15,840***
	South-East Asia	AL	30,764,644	37,697,899	44,739,877	51,884,864	59,141,142
		ASAQ	12,600	14,445	16,325	18,196	20,057
		ASSP	615,859	754,316	894,914	1,037,559	1,182,435
		DP	-	-	-	-	-
		ASMQ	13,497	16,532	19,613	22,739	25,914
		South-East Asia	***31,406,600***	***38,483,192***	***45,670,729***	***52,963,358***	***60,369,548***
	Western Pacific	AL	407,668	472,504	539,808	608,505	678,644
		ASAQ	136,103	170,759	205,703	240,829	276,099
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	37,786	51,413	64,444	77,639	90,976
		Western Pacific	***581,557***	***694,676***	***809,956***	***926,974***	***1,045,719***
	Private Total *(all regions)*	AL	***93,285,185***	***110,672,464***	***128,638,055***	***147,167,244***	***166,258,526***
		ASAQ	***12,172,897***	***14,256,998***	***16,447,070***	***18,723,706***	***21,089,818***
		ASSP	***615,859***	***754,316***	***894,914***	***1,037,559***	***1,182,435***
		DP	-	-	-	-	-
		ASMQ	***51,283***	***67,944***	***84,057***	***100,378***	***116,891***
	Private Total		***106,125,224***	***125,751,722***	***146,064,097***	***167,028,887***	***188,647,669***
TOTAL (across channels)	**Africa**	AL	221,263,030	247,158,974	273,977,735	301,581,148	330,067,689
		ASAQ	79,785,902	89,515,193	99,615,716	110,084,319	120,918,281

		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Africa	***301,048,933***	***336,674,167***	***373,593,451***	***411,665,467***	***450,985,971***
	Americas	AL	400,130	544,616	691,967	841,430	992,956
		ASAQ	12,910	17,378	21,984	26,695	31,505
		ASSP	84,485	117,209	150,750	185,092	220,225
		DP	-	-	-	-	-
		ASMQ	640,893	887,005	1,138,616	1,395,521	1,657,671
		Americas	***1,138,417***	***1,566,208***	***2,003,316***	***2,448,737***	***2,902,357***
	Eastern Mediterranean	AL	7,752,357	9,436,548	11,186,158	12,992,788	14,854,838
		ASAQ	5,501,640	6,085,467	6,677,667	7,276,939	7,890,121
		ASSP	13,967,214	15,759,174	17,623,917	19,562,472	21,572,181
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Eastern Mediterranean	***27,221,211***	***31,281,188***	***35,487,743***	***39,832,198***	***44,317,140***
	Europe	AL	25,676	30,873	36,246	41,772	47,452
		ASAQ	166	214	263	314	365
		ASSP	8,214	9,577	10,962	12,367	13,792
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
		Europe	***34,055***	***40,664***	***47,472***	***54,453***	***61,610***
	South-East Asia	AL	31,696,178	38,806,977	46,028,977	53,356,329	60,797,153
		ASAQ	1,668,913	1,928,998	2,195,245	2,467,484	2,744,471
		ASSP	15,290,038	17,539,878	19,813,739	22,111,661	24,441,686
		DP	-	-	-	-	-
		ASMQ	876,902	973,586	1,070,250	1,166,781	1,263,191
		South-East Asia	***49,532,030***	***59,249,440***	***69,108,211***	***79,102,255***	***89,246,500***
	Western Pacific	AL	1,375,969	1,583,787	1,797,450	2,015,823	2,239,064
		ASAQ	431,601	507,742	584,365	661,302	738,484
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	256,548	293,070	329,046	365,287	402,032
		Western Pacific	***2,064,118***	***2,384,600***	***2,710,861***	***3,042,412***	***3,379,580***
	Total *(all regions)*	AL	***262,513,340***	***297,561,775***	***333,718,533***	***370,829,290***	***408,999,152***
		ASAQ	***87,401,132***	***98,054,992***	***109,095,242***	***120,517,052***	***132,323,228***
		ASSP	***29,349,950***	***33,425,838***	***37,599,368***	***41,871,592***	***46,247,884***
		DP	-	-	-	-	-
		ASMQ	***1,774,343***	***2,153,662***	***2,537,912***	***2,927,589***	***3,322,894***
GRAND TOTAL			***381,038,764***	***431,196,267***	***482,951,054***	***536,145,522***	***590,893,158***

Table 10 - QAACT procurement by channel, by region, by ACT type, 2015 - 2019 (Baseline - Lower bound)

Channel	Region	ACT	2015	2016	2017	2018	2019

		Type					
Public	**Africa**	AL	119,495,200	169,901,300	140,110,400	145,880,900	138,240,500
		ASAQ	67,386,400	129,321,800	128,623,800	74,499,900	72,032,400
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Public Total		***186,881,600***	***299,223,100***	***268,734,200***	***220,380,700***	***210,272,900***
	Americas	AL	117,200	132,200	144,200	135,500	130,700
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Americas Public Total		***117,200***	***132,200***	***144,200***	***135,500***	***130,700***
	Eastern Mediterranean	AL	2,500	4,854,300	2,388,000	3,420,400	3,420,400
		ASAQ	910,700	2,699,200	2,700,100	1,707,200	1,758,300
		ASSP	175,800	3,323,100	1,752,400	2,431,100	2,408,100
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Eastern Med. Public Total		***1,089,100***	***10,876,600***	***6,840,500***	***7,558,700***	***7,586,700***
	Europe	AL	700	4,600	4,200	4,900	4,900
		ASAQ	1,100	7,100	4,200	5,400	5,400
		ASSP	-	200	100	100	100
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Public Total		***1,800***	***11,800***	***8,500***	***10,500***	***10,500***
	South-East Asia	AL	2,225,100	2,616,000	2,130,900	2,407,400	2,397,300
		ASAQ	1,134,300	2,087,900	1,782,300	1,956,700	1,956,700
		ASSP	172,300	223,000	200,000	178,400	178,400
		DP	1,134,300	2,087,900	1,782,300	1,956,700	1,956,700
		ASMQ	-	-	-	-	-
	South-East Asia Public Total		***4,666,000***	***7,014,900***	***5,895,500***	***6,499,100***	***6,489,000***
	Western Pacific	AL	681,100	781,000	787,400	714,000	716,400
		ASAQ	10,800	21,400	21,400	21,400	21,400
		ASSP	300	600	600	600	600
		DP	416,700	750,400	748,700	735,200	735,200
		ASMQ	20,800	12,200	12,400	17,400	17,400
	Western Pacific Public Total		***1,129,700***	***1,565,600***	***1,570,500***	***1,488,500***	***1,490,900***
	Public Total (all regions)	AL	*122,521,800*	*178,289,500*	*145,565,100*	*152,563,100*	*144,910,200*
		ASAQ	*69,443,400*	*134,137,400*	*133,131,800*	*78,190,400*	*75,774,100*
		ASSP	*348,400*	*3,546,800*	*1,953,100*	*2,610,200*	*2,587,200*
		DP	*1,551,100*	*2,838,400*	*2,531,100*	*2,691,900*	*2,691,900*
		ASMQ	*20,800*	*12,200*	*12,400*	*17,400*	*17,400*
	PUBLIC TOTAL		***193,885,500***	***318,824,300***	***283,193,400***	***236,073,000***	***225,980,700***
Private Subsidized	**Africa**	AL	130,893,200	83,638,000	86,498,900	86,498,900	86,498,900
		ASAQ	18,156,200	12,721,900	13,363,000	13,363,000	13,363,000
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Pvt. Sub. Total		***149,049,400***	***96,359,800***	***99,861,900***	***99,861,900***	***99,861,900***
	Americas	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-

		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Americas Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Eastern Mediterranean	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Eastern Med. Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Europe	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	South-East Asia	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	South-East Asia Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Western Pacific	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Western Pacific Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Private Subsidized Total (all regions)	AL	*130,893,200*	*83,638,000*	*86,498,900*	*86,498,900*	*86,498,900*
		ASAQ	*18,156,200*	*12,721,900*	*13,363,000*	*13,363,000*	*13,363,000*
		ASSP					
		DP					
		ASMQ					
	PRIVATE SUBSIDIZED TOTAL		***149,049,400***	***96,359,800***	***99,861,900***	***99,861,900***	***99,861,900***
Premium Private	**Africa**	AL	13,926,700	15,734,500	17,769,200	20,133,400	22,373,600
		ASAQ	3,854,000	4,493,600	5,164,400	5,874,400	6,605,100
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Pre. Pvt. Total		***17,780,700***	***20,228,100***	***22,933,600***	***26,007,800***	***28,978,700***
	Americas	AL	32,300	43,900	55,700	67,600	79,700
		ASAQ	-	-	-	-	-
		ASSP	26,000	35,700	45,700	55,800	66,300
		DP	-	-	-	-	-
		ASMQ	49,900	66,700	83,800	101,400	119,400
	Americas Pre. Pvt. Total		***108,200***	***146,300***	***185,200***	***224,900***	***265,400***
	Eastern Mediterranean	AL	2,200	2,800	3,600	4,400	5,100
		ASAQ	338,300	385,500	433,700	482,900	533,700
		ASSP	2,093,500	2,413,700	2,747,500	3,095,100	3,456,400
		DP	-	-	-	-	-

		ASMQ	-	-	-	-	-
	Eastern Med. Pre. Pvt. Total		***2,434,000***	***2,802,000***	***3,184,800***	***3,582,400***	***3,995,100***
	Europe	AL	31,200	27,800	34,200	42,100	44,600
		ASAQ	-	-	-	-	-
		ASSP	1,200	1,600	1,900	2,300	2,700
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Pre. Pvt. Total		***32,400***	***29,400***	***36,100***	***44,400***	***47,200***
	South-East Asia	AL	13,662,700	17,313,100	20,481,100	23,565,400	27,058,200
		ASAQ	-	-	-	-	-
		ASSP	268,000	341,900	406,800	464,700	534,600
		DP	-	-	-	-	-
		ASMQ	100,700	116,400	132,000	147,300	163,000
	South-East Asia Pre. Pvt. Total		***14,031,400***	***17,771,400***	***21,019,900***	***24,177,400***	***27,755,800***
	Western Pacific	AL	149,700	178,600	208,200	238,600	269,800
		ASAQ	51,500	87,300	62,600	97,400	113,700
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	114,300	127,900	141,800	155,900	170,300
	Western Pacific Pre. Pvt. Total		***315,500***	***393,700***	***412,600***	***492,000***	***553,800***
	Premium Private Total (all regions)	AL	*27,804,800*	*33,300,700*	*38,552,100*	*44,051,500*	*49,831,000*
		ASAQ	*4,243,900*	*4,966,400*	*5,660,700*	*6,454,700*	*7,252,400*
		ASSP	*2,388,700*	*2,792,900*	*3,201,900*	*3,617,900*	*4,060,000*
		DP	-	-	-	-	-
		ASMQ	*264,900*	*311,000*	*357,600*	*404,600*	*452,700*
	PREMIUM PRIVATE TOTAL		***34,702,300***	***41,370,900***	***47,772,200***	***54,528,900***	***61,596,000***
TOTAL (across channels)	**Africa**	AL	264,315,100	269,273,800	244,378,500	252,513,200	247,113,000
		ASAQ	89,396,600	146,537,300	147,151,200	93,737,300	92,000,500
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Total		***353,711,700***	***415,811,000***	***391,529,700***	***346,250,400***	***339,113,500***
	Americas	AL	149,500	176,100	199,900	203,100	210,400
		ASAQ	-	-	-	-	-
		ASSP	26,000	35,700	45,700	55,800	66,300
		DP	-	-	-	-	-
		ASMQ	49,900	66,700	83,800	101,400	119,400
	Americas Total		***225,400***	***278,500***	***329,400***	***360,400***	***396,100***
	Eastern Mediterranean	AL	4,700	4,857,100	2,391,600	3,424,800	3,425,500
		ASAQ	1,249,000	3,084,700	3,133,800	2,190,100	2,292,000
		ASSP	2,269,300	5,736,800	4,499,900	5,526,200	5,864,500
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Eastern Med. Total		***3,523,100***	***13,678,600***	***10,025,300***	***11,141,100***	***11,581,800***
	Europe	AL	31,900	32,400	38,400	47,000	49,500
		ASAQ	1,100	7,100	4,200	5,400	5,400
		ASSP	1,200	1,800	2,000	2,400	2,800
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Total		***34,200***	***41,200***	***44,600***	***54,900***	***57,700***

	South-East Asia	AL	15,887,800	19,929,100	22,612,000	25,972,800	29,455,500
		ASAQ	1,134,300	2,087,900	1,782,300	1,956,700	1,956,700
		ASSP	440,300	564,900	606,800	643,100	713,000
		DP	1,134,300	2,087,900	1,782,300	1,956,700	1,956,700
		ASMQ	100,700	116,400	132,000	147,300	163,000
	South-East Asia Total		***18,697,400***	***24,786,300***	***26,915,400***	***30,676,500***	***34,244,800***
	Western Pacific	AL	830,800	959,600	995,600	952,600	986,200
		ASAQ	62,300	108,700	84,000	118,800	135,100
		ASSP	300	600	600	600	600
		DP	416,700	750,400	748,700	735,200	735,200
		ASMQ	135,100	140,100	154,200	173,300	187,700
	Western Pacific Total		***1,445,200***	***1,959,300***	***1,983,100***	***1,980,500***	***2,044,700***
	Total	AL	*281,219,800*	*295,228,100*	*270,616,000*	*283,113,500*	*281,240,100*
	(all regions)	ASAQ	*91,843,300*	*151,825,700*	*152,155,500*	*98,008,300*	*96,389,700*
		ASSP	*2,737,100*	*6,339,800*	*5,155,000*	*6,228,100*	*6,647,200*
		DP	*1,551,000*	*2,838,300*	*2,531,000*	*2,691,900*	*2,691,900*
		ASMQ	*285,700*	*323,200*	*370,000*	*422,000*	*470,100*
GRAND TOTAL			***377,637,100***	***456,555,000***	***430,827,500***	***390,463,800***	***387,438,600***

Table 11 - QAACT procurement by channel, by region, by ACT type, 2015 - 2019 (Baseline - Upper bound)

Channel	Region	ACT Type	2015	2016	2017	2018	2019
Public	**Africa**	AL	119,495,200	169,901,300	140,110,400	145,880,900	138,240,500
		ASAQ	67,386,400	129,321,800	128,623,800	74,499,900	72,032,400
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Public Total		***186,881,600***	***299,223,100***	***268,734,200***	***220,380,700***	***210,272,900***
	Americas	AL	117,200	132,200	144,200	135,500	130,700
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Americas Public Total		***117,200***	***132,200***	***144,200***	***135,500***	***130,700***
	Eastern	AL	2,500	4,854,300	2,388,000	3,420,400	3,420,400
	Mediterranean	ASAQ	910,700	2,699,200	2,700,100	1,707,200	1,758,300
		ASSP	175,800	3,323,100	1,752,400	2,431,100	2,408,100
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Eastern Med. Public Total		***1,089,100***	***10,876,600***	***6,840,500***	***7,558,700***	***7,586,700***
	Europe	AL	700	4,600	4,200	4,900	4,900
		ASAQ	1,100	7,100	4,200	5,400	5,400
		ASSP	-	200	100	100	100
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Public Total		***1,800***	***11,800***	***8,500***	***10,500***	***10,500***
	South-East Asia	AL	2,225,100	2,616,000	2,130,900	2,407,400	2,397,300
		ASAQ	1,134,300	2,087,900	1,782,300	1,956,700	1,956,700
		ASSP	172,300	223,000	200,000	178,400	178,400
		DP	1,134,300	2,087,900	1,782,300	1,956,700	1,956,700

		ASMQ	-	-	-	-	-
	South-East Asia Public Total		***4,666,000***	***7,014,900***	***5,895,500***	***6,499,100***	***6,489,000***
	Western Pacific	AL	681,100	781,000	787,400	714,000	716,400
		ASAQ	10,800	21,400	21,400	21,400	21,400
		ASSP	300	600	600	600	600
		DP	416,700	750,400	748,700	735,200	735,200
		ASMQ	20,800	12,200	12,400	17,400	17,400
	Western Pacific Public Total		***1,129,700***	***1,565,600***	***1,570,500***	***1,488,500***	***1,490,900***
	Public Total	AL	*122,521,800*	*178,289,500*	*145,565,100*	*152,563,100*	*144,910,200*
	(all regions)	ASAQ	*69,443,400*	*134,137,400*	*133,131,800*	*78,190,400*	*75,774,100*
		ASSP	*348,400*	*3,546,800*	*1,953,100*	*2,610,200*	*2,587,200*
		DP	*1,551,100*	*2,838,400*	*2,531,100*	*2,691,900*	*2,691,900*
		ASMQ	*20,800*	*12,200*	*12,400*	*17,400*	*17,400*
	PUBLIC TOTAL		***193,885,500***	***318,824,300***	***283,193,400***	***236,073,000***	***225,980,700***
Private Subsidized	**Africa**	AL	130,893,200	83,638,000	86,498,900	86,498,900	86,498,900
		ASAQ	18,156,200	12,721,900	13,363,000	13,363,000	13,363,000
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Pvt. Sub. Total		***149,049,400***	***96,359,800***	***99,861,900***	***99,861,900***	***99,861,900***
	Americas	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Americas Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Eastern	AL	-	-	-	-	-
	Mediterranean	ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Eastern Med. Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Europe	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	South-East Asia	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	South-East Asia Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Western Pacific	AL	-	-	-	-	-
		ASAQ	-	-	-	-	-
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Western Pacific Pvt. Sub. Total		**-**	**-**	**-**	**-**	**-**
	Private Subsidized	AL	*130,893,200*	*83,638,000*	*86,498,900*	*86,498,900*	*86,498,900*

	Total (all regions)	ASAQ ASSP DP ASMQ	*18,156,200*	*12,721,900*	*13,363,000*	*13,363,000*	*13,363,000*
	PRIVATE SUBSIDIZED TOTAL		***149,049,400***	***96,359,800***	***99,861,900***	***99,861,900***	***99,861,900***
Premium Private	**Africa**	AL	18,466,400	21,197,600	24,060,400	27,043,800	30,149,500
		ASAQ	6,330,700	7,396,500	8,524,600	9,696,500	10,913,600
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Pre. Pvt. Total		***24,797,100***	***28,594,100***	***32,585,000***	***36,740,200***	***41,063,100***
	Americas	AL	203,500	274,700	347,900	422,500	498,400
		ASAQ	12,600	17,000	21,500	26,100	30,700
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Americas Pre. Pvt. Total		***216,100***	***291,600***	***369,300***	***448,500***	***529,200***
	Eastern Mediterranean	AL	6,537,700	8,032,400	9,585,300	11,187,800	12,838,300
		ASAQ	871,100	996,000	1,126,700	1,260,600	1,398,300
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Eastern Med. Pre. Pvt. Total		***7,408,800***	***9,028,400***	***10,712,100***	***12,448,400***	***14,236,600***
	Europe	AL	692,700	863,300	1,037,300	1,214,300	1,394,600
		ASAQ	200	200	300	300	400
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Pre. Pvt. Total		***692,800***	***863,500***	***1,037,500***	***1,214,600***	***1,394,900***
	South-East Asia	AL	30,100,500	36,868,300	43,741,900	50,715,500	57,797,600
		ASAQ	12,600	14,400	16,300	18,200	20,100
		ASSP	615,900	754,300	894,900	1,037,600	1,182,400
		DP	-	-	-	-	-
		ASMQ	13,500	16,500	19,600	22,700	25,900
	South-East Asia Pre. Pvt. Total		***30,742,400***	***37,653,600***	***44,672,700***	***51,794,000***	***59,026,000***
	Western Pacific	AL	407,700	472,500	539,800	608,500	678,600
		ASAQ	136,100	170,800	205,700	240,800	276,100
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	37,800	51,400	64,400	77,600	91,000
	Western Pacific Pre. Pvt. Total		***581,600***	***694,700***	***810,000***	***927,000***	***1,045,700***
	Premium Private Total (all regions)	AL	*56,408,400*	*67,708,700*	*79,312,600*	*91,192,500*	*103,357,000*
		ASAQ	*7,363,300*	*8,595,000*	*9,895,100*	*11,242,500*	*12,639,200*
		ASSP	*615,900*	*754,300*	*894,900*	*1,037,600*	*1,182,400*
		DP	-	-	-	-	-
		ASMQ	*51,300*	*67,900*	*84,000*	*100,300*	*116,900*
	PREMIUM PRIVATE TOTAL		***64,438,800***	***77,125,900***	***90,186,600***	***103,572,900***	***117,295,600***
TOTAL (across	**Africa**	AL	268,854,800	274,736,900	250,669,700	259,423,600	254,888,900
		ASAQ	91,873,300	149,440,200	150,511,400	97,559,400	96,309,000

channels)							
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Africa Total		***360,728,100***	***424,177,000***	***401,181,100***	***356,982,800***	***351,197,900***
	Americas	AL	320,700	406,900	492,100	558,000	629,100
		ASAQ	12,600	17,000	21,500	26,100	30,700
		ASSP	-	-	-	-	-
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Americas Total		***333,300***	***423,800***	***513,500***	***584,000***	***659,900***
	Eastern	AL	6,540,200	12,886,700	11,973,300	14,608,200	16,258,700
	Mediterranean	ASAQ	1,781,800	3,695,200	3,826,800	2,967,800	3,156,600
		ASSP	175,800	3,323,100	1,752,400	2,431,100	2,408,100
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Eastern Mediterranean Total		***8,497,900***	***19,905,000***	***17,552,600***	***20,007,100***	***21,823,300***
	Europe	AL	693,400	867,900	1,041,500	1,219,200	1,399,500
		ASAQ	1,300	7,300	4,500	5,700	5,800
		ASSP	-	200	100	100	100
		DP	-	-	-	-	-
		ASMQ	-	-	-	-	-
	Europe Total		***694,600***	***875,300***	***1,046,000***	***1,225,100***	***1,405,400***
	South-East Asia	AL	32,325,600	39,484,300	45,872,800	53,122,900	60,194,900
		ASAQ	1,146,900	2,102,300	1,798,600	1,974,900	1,976,800
		ASSP	788,200	977,300	1,094,900	1,216,000	1,360,800
		DP	1,134,300	2,087,900	1,782,300	1,956,700	1,956,700
		ASMQ	13,500	16,500	19,600	22,700	25,900
	South-East Asia Total		***35,408,400***	***44,668,500***	***50,568,200***	***58,293,100***	***65,515,000***
	Western Pacific	AL	1,088,800	1,253,500	1,327,200	1,322,500	1,395,000
		ASAQ	146,900	192,200	227,100	262,200	297,500
		ASSP	300	600	600	600	600
		DP	416,700	750,400	748,700	735,200	735,200
		ASMQ	58,600	63,600	76,800	95,000	108,400
	Western Pacific Total		***1,711,300***	***2,260,300***	***2,380,500***	***2,415,500***	***2,536,600***
	Total	AL	*309,823,500*	*329,636,200*	*311,376,600*	*330,254,400*	*334,766,100*
	(all regions)	ASAQ	*94,962,800*	*155,454,200*	*156,389,900*	*102,796,100*	*101,776,400*
		ASSP	*964,300*	*4,301,200*	*2,848,000*	*3,647,800*	*3,769,600*
		DP	*1,551,000*	*2,838,300*	*2,531,000*	*2,691,900*	*2,691,900*
		ASMQ	*72,100*	*80,100*	*96,400*	*117,700*	*134,300*
GRAND TOTAL			***407,373,600***	***492,310,000***	***473,242,000***	***439,507,800***	***443,138,200***

Table 12 - Artemisinin oral monotherapy demand, by region, by channel, 2015 – 2019

Channel	Region	2015	2016	2017	2018	2019
Public	Africa	-	-	-	-	-
	Americas	-	-	-	-	-
	Eastern Mediterranean	-	-	-	-	-
	Europe	-	-	-	-	-

	South-East Asia	-	-	-	-	-
	Western Pacific	-	-	-	-	-
	Public Total	**-**	**-**	**-**	**-**	**-**
Private Formal	Africa	179,518	147,950	114,490	84,556	71,427
	Americas	2,006	1,888	1,326	889	629
	Eastern Mediterranean	37,423	30,234	19,439	12,466	8,717
	Europe	63	57	39	26	18
	South-East Asia	17,169	8,021	5,040	3,915	3,490
	Western Pacific	9,187	6,301	6,406	6,833	7,532
	Private Formal Total	**245,366**	**194,451**	**146,740**	**108,685**	**91,813**
Private Informal	Africa	478,290	402,547	325,449	248,068	218,584
	Americas	2,427	2,294	1,615	1,085	768
	Eastern Mediterranean	62,754	50,473	32,005	20,060	13,570
	Europe	92	82	56	37	26
	South-East Asia	10,554	6,934	4,860	3,808	3,339
	Western Pacific	12,368	8,702	8,147	8,194	8,735
	Private Formal Total	**566,485**	**471,032**	**372,133**	**281,251**	**245,022**
Total	Africa	657,808	550,496	439,939	332,624	290,011
(across channels)	Americas	4,433	4,182	2,940	1,974	1,397
	Eastern Mediterranean	100,177	80,707	51,445	32,525	22,287
	Europe	155	139	95	63	44
	South-East Asia	27,723	14,955	9,900	7,724	6,829
	Western Pacific	21,555	15,003	14,553	15,027	16,267
Grand Total		**811,851**	**665,483**	**518,873**	**389,936**	**336,835**

Table 13 - QA injectable artesunate public sector procurement by region, 2015 – 2019 (60 mg. vials)

Region	2015	2016	2017	2018	2019
Africa	16,638,000	23,141,500	19,715,700	18,527,900	17,793,600
Americas	-	-	-	-	-
Eastern Mediterranean	101,800	1,637,900	1,618,700	1,138,300	1,138,300
Europe	-	-	-	-	-
South-East Asia	-	-	-	-	-
Western Pacific	34,400	33,000	20,000	18,900	18,900
TOTAL	**16,774,200**	**24,812,500**	**21,354,400**	**19,685,200**	**18,950,800**

Table 14 - Rectal artemisinin demand, by channel, by region, by formulation, 2015 – 2019

Channel	Region	Formulation	2015	2016	2017	2018	2019
Public	**Africa**	80mg. artemether	463,702	516,521	586,475	663,839	727,984
		100 mg. artesunate	5,605,233	6,174,242	6,781,963	7,413,873	8,043,502
	Americas	80mg. artemether	34	47	60	73	86

		100 mg. artesunate	44,460	61,443	78,774	96,435	114,423
	Eastern Mediterranean	80mg. artemether	4,820	5,572	6,352	7,162	8,002
		100 mg. artesunate	908,765	1,018,906	1,132,739	1,250,378	1,371,994
	Europe	80mg. artemether	0	0	0	0	0
		100 mg. artesunate	1,306	1,528	1,755	1,987	2,226
	South-East Asia	80mg. artemether	1,246	1,513	1,785	2,062	2,343
		100 mg. artesunate	867,249	992,629	1,119,435	1,247,659	1,377,612
	Western Pacific	80mg. artemether	2,707	3,076	3,453	3,839	4,232
		100 mg. artesunate	47,450	54,890	62,432	70,074	77,831
	Public Total	**80mg. artemether**	**472,510**	**526,729**	**598,126**	**676,975**	**742,647**
		100 mg. artesunate	**7,474,463**	**8,303,638**	**9,177,098**	**10,080,406**	**10,987,587**
Private	**Africa**	80mg. artemether	779,962	872,346	969,067	1,083,191	1,198,748
		100 mg. artesunate	990,369	1,092,386	1,199,607	1,349,925	1,486,511
	Americas	80mg. artemether	1,768	2,382	3,006	3,644	4,297
		100 mg. artesunate	2,383	3,211	4,053	4,913	5,793
	Eastern Mediterranean	80mg. artemether	39,711	45,577	51,642	57,988	64,610
		100 mg. artesunate	53,533	61,442	69,617	78,172	87,100
	Europe	80mg. artemether	62	79	97	116	135
		100 mg. artesunate	83	107	131	156	182
	South-East Asia	80mg. artemether	3,878	4,600	5,324	6,057	6,797
		100 mg. artesunate	5,228	6,202	7,177	8,165	9,163
	Western Pacific	80mg. artemether	3,387	3,872	4,367	4,878	5,405
		100 mg. artesunate	4,565	5,220	5,887	6,576	7,287
	Private Total	**80mg. artemether**	**828,767**	**928,857**	**1,033,503**	**1,155,874**	**1,279,993**
		100 mg. artesunate	**1,056,161**	**1,168,567**	**1,286,472**	**1,447,907**	**1,596,035**
Total (across channels)	**Africa**	80mg. artemether	1,243,665	1,388,867	1,555,542	1,747,030	1,926,733
		100 mg. artesunate	6,595,602	7,266,628	7,981,570	8,763,798	9,530,013
	Americas	80mg. artemether	1,802	2,429	3,066	3,717	4,383
		100 mg. artesunate	46,843	64,655	82,827	101,348	120,216
	Eastern Mediterranean	80mg. artemether	44,531	51,149	57,995	65,150	72,612
		100 mg. artesunate	962,297	1,080,348	1,202,356	1,328,550	1,459,093
	Europe	80mg. artemether	62	79	97	116	135
		100 mg. artesunate	1,390	1,635	1,886	2,143	2,407
	South-East Asia	80mg. artemether	5,124	6,113	7,109	8,118	9,141
		100 mg. artesunate	872,477	998,830	1,126,612	1,255,824	1,386,776
	Western Pacific	80mg. artemether	6,094	6,948	7,821	8,717	9,637
		100 mg. artesunate	52,016	60,110	68,319	76,651	85,118
GRAND TOTAL		**80mg. artemether**	**1,301,277**	**1,455,586**	**1,631,629**	**1,832,849**	**2,022,640**
		100 mg. artesunate	**8,530,625**	**9,472,205**	**10,463,570**	**11,528,313**	**12,583,622**

Table 15 - RDT demand by channel, by region, 2015 – 2019

Channel	Region	2015	2016	2017	2018	2019
Public	Africa	255,084,451	262,014,901	268,998,287	276,063,169	283,246,209
	Americas	475,104	481,194	487,199	493,125	498,988
	Eastern Mediterranean	34,672,890	35,486,596	36,317,216	37,162,459	38,018,520
	Europe	-	-	-	-	-
	South-East Asia	10,893,510	11,001,748	11,104,846	11,203,773	11,300,258
	Western Pacific	1,663,389	1,690,521	1,716,882	1,742,559	1,767,719
	Public Total	**302,789,343**	**310,674,959**	**318,624,431**	**326,665,084**	**334,831,694**
Private Formal	Africa	32,059,098	32,956,816	33,866,297	34,790,930	35,734,703
	Americas	74,871	75,859	76,833	77,796	78,750
	Eastern Mediterranean	8,157,565	8,321,317	8,489,600	8,661,460	8,835,092
	Europe	-	-	-	-	-
	South-East Asia	20,087,180	20,304,013	20,509,896	20,707,043	20,899,925
	Western Pacific	333,640	338,870	344,001	349,041	354,009
	Private Total	**60,712,354**	**61,996,874**	**63,286,627**	**64,586,271**	**65,902,479**
Private Informal	Africa	36,303,748	37,304,900	38,314,394	39,334,941	40,371,278
	Americas	25,145	25,478	25,810	26,139	26,466
	Eastern Mediterranean	4,043,572	4,136,655	4,232,514	4,330,610	4,430,145
	Europe	-	-	-	-	-
	South-East Asia	2,288,202	2,313,740	2,339,024	2,364,005	2,388,597
	Western Pacific	196,755	199,980	203,175	206,338	209,469
	Private Formal Total	**42,857,423**	**43,980,753**	**45,114,917**	**46,262,034**	**47,425,955**
Total *(across channels)*	Africa	323,447,297	332,276,616	341,178,979	350,189,040	359,352,190
	Americas	575,120	582,530	589,842	597,061	604,204
	Eastern Mediterranean	46,874,027	47,944,568	49,039,330	50,154,530	51,283,757
	Europe	-	-	-	-	-
	South-East Asia	33,268,892	33,619,501	33,953,766	34,274,821	34,588,780
	Western Pacific	2,193,784	2,229,372	2,264,059	2,297,937	2,331,197
Grand Total		**406,359,120**	**416,652,587**	**427,025,976**	**437,513,389**	**448,160,128**

Table 16 - RDT procurement by channel, by region, 2015 – 2019

Channel	Region	2015	2016	2017	2018	2019
Public	Africa	160,981,900	247,610,700	235,994,500	189,665,100	189,570,100
	Americas	1,626,900	4,073,900	4,717,500	4,738,000	4,738,000
	Eastern Mediterranean	3,536,900	8,184,500	7,703,400	6,000,200	6,003,700
	Europe	71,600	187,400	228,500	253,700	253,700
	South-East Asia	5,690,600	6,651,800	7,273,000	6,422,400	6,450,000

	Western Pacific	5,615,000	11,300,200	10,956,600	8,787,200	7,582,900
	Public Total	**177,523,000**	**278,008,600**	**266,873,500**	**215,866,500**	**214,598,400**
Private	Africa	53,766,800	55,247,900	56,744,100	58,260,000	59,801,900
	Americas	7,518,900	7,696,900	7,874,600	8,053,100	8,234,900
	Eastern Mediterranean	13,530,100	13,825,800	14,129,200	14,438,700	14,752,000
	Europe	4,219,400	4,322,900	4,427,600	4,533,600	4,641,100
	South-East Asia	20,444,200	20,680,100	20,905,400	21,122,400	21,335,600
	Western Pacific	4,090,300	4,204,100	4,320,800	4,440,400	4,562,900
	Private Total	**103,569,800**	**105,977,600**	**108,401,500**	**110,848,300**	**113,328,400**
Total	Africa	214,748,700	302,858,600	292,738,600	247,925,100	249,372,000
	Americas	9,145,800	11,770,800	12,592,100	12,791,100	12,972,900
	Eastern Mediterranean	17,067,000	22,010,300	21,832,600	20,438,900	20,755,700
	Europe	4,291,000	4,510,300	4,656,100	4,787,300	4,894,800
	South-East Asia	26,134,800	27,331,900	28,178,400	27,544,800	27,785,600
	Western Pacific	9,705,300	15,504,300	15,277,400	13,227,600	12,145,800
GRAND TOTAL		**281,092,700**	**383,986,200**	**375,275,000**	**326,714,800**	**327,926,800**

VI. APPENDIX B: REFERENCES

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